DIV. OF FISHES

COMMERCIAL FISHERIES Review

VOL. 32, NOS. 8-9 AUGUST-SEPTEMBER 1970

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Vol. 32
Nos. 8-9
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COVER: View from BCF's 'Albatross IV' during survey cruise in Atlantic. (R. K. Brigham)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

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Gloucester, Mass.

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The Bureau of Commercial Fisheries and
The Bureau of Sport Fisheries and Wildlife
make up The Fish and Wildlife Service of
The United States Department of the Interior.

Throughout this book, the initials BCF stand
for the Bureau of Commercial Fisheries.

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Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.
Price 60 cents (single copy). Subscription Price: $7.00 a year; $2 additional for foreign mailing.

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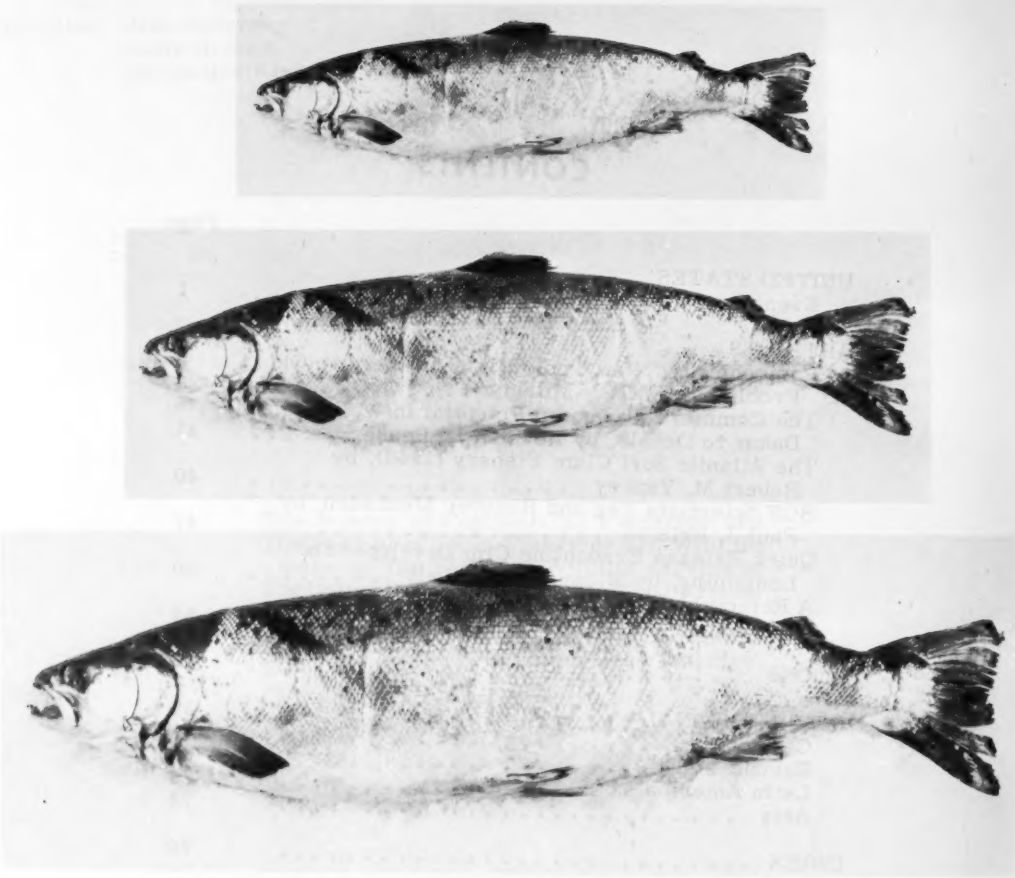


ATLANTIC SALMON (R. K. Brigham)

ATLANTIC SALMON NEEDS INTERNATIONAL PROTECTION, DR. GLASGOW SAYS

Conservation of the Atlantic salmon depends significantly on international cooperation and careful management, believes Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife and Parks. He served this year as chief of U.S. delegation to annual meeting of International Commission for the Northwest Atlantic Fisheries.

ICNAF has recommended that its 15 member nations keep high-seas catches of salmon in Northwest Atlantic at 1969 level.

Salmon are hatched and spend their early life in freshwater coastal streams. Then they go to sea, where they migrate long distances before returning to native streams to spawn. The cycle is repeated.

Need for Controls Surfaces

The need for international controls became apparent in the mid-1960s, when high-seas fishing for salmon developed off Greenland. That island has no significant salmon-producing rivers. Many of the salmon caught off Greenland must have hatched elsewhere.

Dr. Glasgow said: "Fishing for salmon on the high-seas is contrary to principles of good conservation. It is essential to allow a certain number of salmon to escape to each spawning stream in order to maintain the resource. This can be done only if fishing operations are restricted to inshore waters and streams, where close supervision is possible."

ICNAF's Work

ICNAF coordinates high-seas conservation of fisheries in the Northwest Atlantic. Its members include the principal countries fishing there. It has sponsored studies that show some salmon caught off Greenland come from streams in Great Britain, Canada, and the U.S.

In 1969, ICNAF recommended a complete ban on salmon fishing in international waters; this proposal was not accepted by Denmark and West Germany. However, these countries agreed to catch limitation proposed for 1971. Denmark has the largest salmon fishing fleet off Greenland.

U.S. Position

"The freeze on 1971 catches is an interim measure and far from satisfactory," Dr. Glasgow has stated. "The United States approved this proposal only when it became clear that agreement could not be reached on more effective measures. Over the long term, stronger international controls will be necessary to serve the interests of good conservation. We shall do our utmost to this end."

HERRING AND MENHADEN APPROVED FOR FPC

The Food and Drug Administration (FDA) has approved the use of herring and menhaden in producing fish protein concentrate (FPC). FDA had examined data supplied by BCF before acting. Only hake and hakelike fishes had been approved before.

The value of recovered oil from herring and menhaden will reduce costs of producing FPC, a virtually odorless, tasteless light-tan powder made from whole fish. FPC contains over 75% animal protein and several nutritionally beneficial minerals.

Worldwide use of FPC could help provide a better-balanced diet for undernourished millions. It also offers profitable use of many unused fish off U.S. coasts.

Aberdeen FPC Plant

Assistant Secretary of the Interior Leslie Glasgow said August 25 that an experimental and demonstrational plant being built at Aberdeen, Washington, is scheduled for completion late this year. It is designed to process up to 50 tons of raw fish during a 24-hour day--and to produce up to 7.5 tons of high-quality FPC. The plant is intended to demonstrate the feasibility of manufacturing FPC by a BCF-developed extraction process using isopropyl alcohol. The plant also will provide a basis for design and construction of privately owned full-scale plants.

About 25¢ A Pound

Nutritionists estimate 750 million people suffer from a serious protein deficiency in their daily food--and their number is increasing daily. Commercial development of the BCF extraction process using hake is expected to provide a product costing about 25 cents a pound. This could compete easily with other available animal protein supplements on a protein-content basis. Tests have shown that less than half an ounce of FPC per day will produce a remarkable improvement in a protein-deficient diet.

LAND FIRST COMMERCIAL CATCH OF PELAGIC RED CRAB

The 'American Eagle' landed the first commercial load of pelagic red crabs in San Pedro, Calif., in July. The Starkist Food Co. bought the 1,700-pound catch.

BCF gear, a 16-foot otter trawl, and a 5' x 5' Blackburn neuston net were used to catch the crabs in international waters off southern Baja California. Rough seas permitted only 2 days of fishing during the 7-day trip. A BCF biologist was aboard.

Catching and Preparing Crabs

Both bottom and midwater trawls caught red crabs successfully. Samples were collected and prepared in several forms: whole, raw; ground, raw; and ground, cooked. The crabs were preserved in the spray-brine tank, or in a chest freezer.

The samples will be used by the BCF Technological Laboratory in Seattle, Wash., for analysis and experimental processing. According to lab director Dr. Maynard Steinberg, the most promising use of red crabs seems to be for pet food or animal feed.

110,000-TON QUOTA SET FOR CALIFORNIA ANCHOVY REDUCTION

An anchovy catch quota for reduction of 110,000 tons for the 1970-71 season--10,000 tons for Northern Permit Area and 100,000 tons for Southern--was approved on July 31 by the California Department of Fish and Game.

Fishermen are restricted from fishing for anchovy for reduction in designated zones ranging from 3 to 6 miles offshore.

The season opened August 1 for the northern area, and September 15 for the southern area. The fishery will be closed during February 1971. The season will end when the quotas have been attained, or on May 15, 1971.

U.S. FOOD SITUATION

"Food prices have increased much less rapidly in recent months than they did last fall and winter," reports the U.S. Department of Agriculture. In June 1970, food prices averaged 1.3% (seasonally adjusted annual rate) over March, and 3.3% over last December. This contrasted with gain of 5.7% for total Consumer Price Index. Much of the increase for food resulted from higher prices of food eaten outside the home. Retail-store prices of food rose a fraction.

Price Decline in Fall

"Food prices may show a small seasonal increase this summer," Agriculture Department states, "but they likely will decline more than seasonally this fall if the red meat supply, especially pork, increases as expected. Seasonally large supplies of fresh fruits, vegetables, and potatoes also will contribute to lower prices later this year." For 1970 as a whole, the total food price index may average about 5% above 1969. This will be due partly to large increases between fourth-quarter 1969 and first-quarter 1970.

Per-Capita Consumption Up

Per-capita consumption of food will increase this year. Contributing to rise will be expected increases in consumption of poultry, fish, fruit, potatoes, and sugar. Meat consumption also is expected to rise slightly. Less consumption of dairy products is in prospect.

Smaller % of Income For Food

Food expenditures increased 1% in second-quarter 1970, the smallest advance since late 1968. However, spending was still over 8% higher than in second-quarter 1969. For 1970, expenditures may total around $113 billion; 1969's were $105 billion. Disposable income probably will increase more than expenditures. This will lead to a decline from 16.7% in 1969 (revised) to 16.5% this year in proportion of income spent for food.

Food Prices

Between January and June 1970, retail food prices rose less than half as fast as prices for nonfood goods and services. There was a 1.5% increase for food compared with a 2.9% increase in prices of nonfood items. Prices of all consumer goods and services rose 2.6%. Since 1957-59, prices of all nonfood items have increased around 36%; total food prices have risen 32½%. Prices of food in stores rose 28%, and eating-place prices rose 55%.

The retail price index for all food averaged 7% higher during January-June 1970 than during same period 1969. Retail-store prices rose 6.7%, while prices of food eaten outside home went up nearly 8%.

SUPPLIES OF FISHERY PRODUCTS INCREASE

Supplies of edible fish during January-June 1970 rose an estimated 6% above first-half 1969. Supplies were lifted by a 14% rise in imports over a year ago, and an increase of about 4% in domestic catch.

Fish landings in the New England area for first 6 months of 1970 were a fraction below a year earlier. U.S. fishermen caught only about half the haddock of a year earlier. However, there were gains in flounder, ocean perch, pollock, and whiting.

Among the other major U.S. fisheries, shrimp "is well on its way" toward record production; catches are running 13% above last year. Pacific halibut landings probably will be a little below last year; tuna likely will be about the same.

Imports Much Above 1969

Imports of major edible fishery products are considerably above 1969. Imports of fillets are up 25%--led by sharp increases for cod, flounder, and haddock. The only sizable drop has been in ocean-perch fillets. Receipts of raw materials for fish sticks and portions have increased 15%. Imports of sardines are about 10% above 1969.

Imports of foreign lobsters have declined this year, but imports of shrimp are 17% above a year ago.

Inventories of frozen fish and shellfish are 11% higher than last year. Inventories of frozen fillets are up a third; stocks of cod and flounder fillets are substantially larger. Frozen haddock fillets are up slightly; stocks of ocean-perch fillets are down slightly.

Cold-storage holdings of shellfish are 11% above 1969 because of larger shrimp stocks. Most other shellfish are slightly below year-ago levels.

Strong Demand

Demand for fishery products was strong in first-half 1970. This continued 1968 and 1969 trends. Movement of most products is reported good. Fish prices are averaging 8 to 9% above a year ago.

Supplies Ample

Supplies of most fishery products will increase seasonally for the remainder of this summer. They are expected to be ample for trade needs. Price levels generally will continue higher than in 1969.

Large catches of Alaska salmon will ensure plentiful supplies of frozen and canned salmon for current marketing year. Supplies of most frozen fillets are higher than last year. Production of the popular fish sticks and fish portions is well above year-ago levels. Supplies of most shellfish will be adequate. Shrimp are expected to be plentiful for remainder of 1970.

CONSUMPTION OF SHELLFISH RISES 12% ABOVE 1969

From January-July, consumption of fresh and frozen shrimp, northern lobsters, spiny lobster tails, and sea scallops increased about 12% over a year earlier. These items made up 62% of all U. S. shellfish consumption in 1969.

Consumption of fresh and frozen shrimp has risen 15% in 1970; lobster tails have shown a moderate increase; sea scallops are a fraction ahead of last year; and northern lobster consumption is off a little.

SHRIMP-SEPARATOR TRAWLS TESTED IN GULF OF MEXICO

Tests of shrimp-separator trawls have been conducted in Gulf of Mexico by BCF's Pascagoula (Miss.) Exploratory Fishing and Gear Research Base. Two western-type, 70-ft., semiballoon shrimp trawls were modified into shrimp-separator trawls and tested on brown-shrimp grounds.

The horizontal panel trawl (modified Pascagoula design) was slightly more effective than vertical panel trawl (modified Seattle design) in channeling shrimp into the side or shrimp bags; but the former had a higher percentage of fish contamination.

The separating percentage for both trawls was below earlier trials with 40-ft. separator trawls. This is attributable partly to: (1) small fish encountered; (2) large horizontal opening of trawl, which permitted more shrimp to reach fish bag without contacting separator panel; (3) size of mesh in separator; and (4) basic design of western semiballoon trawl.

The Modified Designs

The modified designs, though less satisfactory at sorting shrimp, were much more efficient catchers of shrimp and fish than earlier models; they caught as much as standard trawls.

The accumulated data indicate strongly that radical design changes are required. Possibly, observations by SCUBA divers will be necessary before developing a commercially effective separator trawl for penaeid shrimp in the Gulf of Mexico.

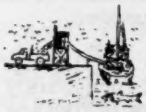
EXCESS LAKE MICHIGAN SALMON WILL BE HARVESTED

An estimated 3 million pounds of salmon surplus to the needs of sport fishermen in fall 1970 will be taken from Lake Michigan streams for processing. The Michigan Department of Natural Resources has authorized the Blackport Packing Co. of Grand Rapids to do the job.

Terms of Contract

If the fish meet State and Federal food standards, they will be made available to qualified buyers in Michigan at a fair market price. Also, Blackport will process about 50,000 coho and chinook salmon for free distribution to Michigan's licensed salmon fishermen.

The 3 million pounds to be processed, and the free salmon, will be collected at 3 weirs operated by the Department of Natural Resources.



MAINE SARDINE COUNCIL SEEKS ANSWER TO HERRING SCARCITY

The Maine Sardine Council has made a grant for a study of the effect of environmental conditions on the habits, supply, and movement of herring along the Maine coast. The work will be done by The Research Institute Gulf of Maine (TRIGOM) and the Maine Medical Center.

Richard E. Reed, council executive secretary, said the most serious scarcity of fish in 10 years triggered the action.

Traditional runs of sardine-size fish have failed to appear. Maine's 21 sardine canneries have been operating at 20% or less of capacity since January. Reed said the condition existed over most of the Gulf of Maine because the Canadian industry was having the same problem.

Study Goals

Reed described the study goals: "We hope to find some clues that will permit our industry to anticipate the extent of fluctuations in herring supply that may be expected from year to year, determine the cause and then seek an effective plan for conservation and management of the fishery. New techniques and approaches developed by TRIGOM and the Medical Center will supplement extensive biological research that has been carried on by state and federal agencies for the past 25 years."

ESTIMATION OF FISH STOCKS BEING IMPROVED

Haddock stocks in the northwest Atlantic Ocean are under strong international regulations because of increased fishing and low recruitment. Regulation of the yellowtail flounder fishery because of increased fishing also has been proposed.

Characteristics of fishing fleets have been changing. Vessels previously used for standard measurements of fish are no longer fishing the same species.

Improved Estimates Needed

According to BCF's Biological Laboratory, Woods Hole, Mass., international regulations and changing fisheries have made acute the need to improve estimates of vital statistics. One statistic is relative abundance. Generally, it is expressed as landings per-unit-effort. Estimates of factors necessary to assess stocks depend upon estimates of abundance. The more precise this abundance estimate can be made, the higher the confidence that can be placed on the population factors.

Logbooks Issued

The standard method of obtaining fishing effort has been to interview the vessel's captain at dockside after a trip. However, this provides limited effort and discard information. To obtain more precise observations of effort and catch, on-board vessel logbooks are used. Segments of the haddock, yellowtail flounder, and ocean perch (redfish) fleets have been issued logbooks. Data from this sample will be the basis for evaluating the system. After necessary refinements are made, the logbooks will be put into general use.

SKIPJACK TUNA DISTRIBUTION IN PACIFIC MAY BE CHANGING

The results of a series of 5 oceanography-fishery cruises to the equatorial Pacific by BCF Honolulu suggest that skipjack tuna are increasing 500-1,000 miles southeast of Hawaii--while they are decreasing in Hawaiian area.

This could indicate a seasonal shift southward. BCF is investigating the subject thoroughly.

OREGON'S SHRIMP FISHERY REMAINS STRONG

Shrimp boats fishing off Oregon this year have landed 7.9 million pounds in Oregon's coastal ports through July, reports Jack Robinson, Fish Commission biologist in charge of monitoring the state's million-dollar-plus industry.

Landings should top 10 million pounds in 1970, says Robinson, the fourth highest on record. Although the high was 11 million pounds in 1968, the annual catch over the past 10 years has been a little over 4 million pounds. The fishery, which opened March 1, closes October 31.

Productive Areas

Coos Bay, with over 3 million pounds, is high port; landings at Newport are 1,067,000 pounds. Other productive areas for the cocktail-size shrimp include Astoria and Garibaldi.

Landings might have gone even higher, notes Robinson, except for poor market conditions in May, June, and July.

SIGNAL CRAYFISH FISHERY IS DEVELOPING IN PACIFIC NORTHWEST

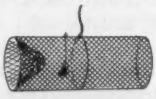
A fishery for signal crayfish, Pacifastacus leniusculus, is beginning to develop in the Pacific Northwest. This species apparently is similar to the European species. A shortage in Europe has fostered great demand in Scandinavia.

At the end of July, fishermen were getting about 40 cents a pound--but price has been as high as a dollar. Average size crayfish are 4 to 5 inches, 12 to 14 per pound.

Wide Distribution

Assessment of the resource has not begun, but indications are that species can be found in most lakes and streams in Northwest and in Northern California.

Cylindrical crayfish pots--2' by 10" diameter--have been built for testing.



SALT-WATER REARING OF SALMON IS TESTED

BCF Seattle Biological Laboratory staff are conducting experiments to determine the relation among water temperature, feed, and growth of salmon. They are using a system of screened pens and webbing enclosures supported by floating rafts attached to a pier.

First Trials Encouraging

Initial trials with coho salmon were very encouraging. In July 1969, 0.7-ounce fingerlings were placed in saltwater pens; by January 1970, they had grown to an average weight of 10 ounces. Conversion rate was 1.4 pounds of feed per pound of fish during late summer. This compares with conversion rate range of 1.2 to 1.5 pounds of feed per pound of fish under normal hatchery operations for cohos. During winter, the growth rate slowed, but the fish remained in excellent condition.

'KELEZ' STUDIES HIGH-SEAS RED SALMON POPULATION

BCF's 'George B. Kelez' has been indexing the red salmon population on the high seas south of the Aleutian Peninsula. Gillnet catches on August 15 and 16 were exceptionally high (445 red salmon on the 16th). Fish that have been at sea through one winter are designated .1 fish. The proportion of these fish is much higher than expected following this year's large run to Bristol Bay.

.1s are 80% of Reds

Eighty percent of the reds caught on the cruise have been .1s. The .2 reds (at sea through two winters) are not as abundant as usual following a large run; .1 fish are more abundant than usual.

The .3 fish usually move farther west than younger age groups--beyond abstention line at 175° W. longitude. This may mean that in 1971 there will be fewer North American fish exposed to the Japanese compared to other years following peak runs.

ROCKFISH SHOW STRONG HOMING INSTINCT

Tagged yellowtail rockfish from a submerged wreck north of Juneau, Alaska, have shown remarkable ability to return home. So far, 10 of 34 fish released at Auke Bay, 6 miles away, have returned; another quickly found its way across a channel one mile wide and 300 feet deep to return to the wreck.

The fish released from Auke Bay also had good "memory": they had been captive for 3 months before release.

CAMBRIDGE (MD.) WELCOMES ICELAND'S 'GODAFOSS' ON MAIDEN VOYAGE

On August 14, residents of Cambridge, Md., welcomed the Icelandic vessel Godafoss on her maiden voyage. The visit was significant to Cambridge: the vessel carried 3,000 tons of fish, the largest single load of fish to reach the port. Also, it marked the beginning of a biweekly service of 3 Iceland Steamship Co. vessels between Reykjavik and Cambridge

The Godafoss

The fully automated Godafoss is represented in Cambridge by Terminal Shipping Co. She features three 5-ton-capacity hydraulic deck cranes; two of the three can be operated together as a twin crane of 10-ton capacity.

The vessel has a cargo capacity of 150,000 cubic feet. Her holds are insulated to permit transportation of refrigerated and dry cargoes.

WILLIAM TERRY APPOINTED U.S. COMMISSIONER ON IATTC

On Aug. 13, the President appointed William M. Terry a U.S. Commissioner on the Inter-American Tropical Tuna Commission (IATTC). He succeeds J. Lawrence McHugh, who has resigned. Terry is Acting Deputy Director of BCF.

IATTC's Role

The Commission, created in 1950, conducts scientific investigation of tuna and bait fishes in the Eastern Pacific Ocean. It collects and interprets information necessary to maintain stocks of tuna and bait fishes at levels that will permit maximum sustained yields. Also, IATTC recommends to governments conservation measures indicated by its investigations.

MEETINGS

FISH EXPO '70 OPENS IN TAMPA, FLORIDA, OCT. 14

Fish Expo '70 will be held at the Curtis Hixon Convention Center on Hillsborough River in Tampa, Florida, Oct. 14-17.

Fish Expo originated in Boston, Mass., in 1967, and was held there again in 1968. Fish Expo '69 took place in Seattle, Washington, where gross sales from the exhibition floor reportedly were over $1,000,000.

Show Hours & Features

The show hours for the trade will be 12 noon to 6 p.m. From 10 a.m. to 12 noon, seminars will be conducted on the detection, catching, handling, processing, and marketing of fish; fishing vessels; and vessel subsidies.

Several otter trawl vessels built of wood, steel, fiber glass, aluminum, and cement will be displayed at the dock. These will give fishermen an opportunity to compare fishing vessels built of different materials. Exhibitors from the U.S., Canada, Mexico, Norway, England, Germany, France, Portugal, Denmark, and Japan will show latest fishing gear and equipment available to the commercial fishing industry.

BCF's Market News Service

The BCF exhibit will include a temporary Fisheries Market News Service office complete with teletype machine. On business days, information will be available on current fish and shellfish landings, receipts, prices, and market trends.

ATLANTIC & GULF GROUPS TO MEET

The annual meetings of the Atlantic States Marine Fisheries Commission and the Gulf States Marine Fisheries Commission will be held jointly at International Inn, Tampa, October 14-16.

TROUT FARMERS TO MEET IN CALIFORNIA, OCT. 28-30

The Eighteenth Annual Convention of the U.S. Trout Farmers Association will be held October 28, 29, and 30 at the Sacramento Inn, Sacramento, California. It is not limited to trout culturists.

The convention will feature a tour of hatching and rearing facilities on Oct. 29. Trout farm equipment will be demonstrated.

Highlights

Reports will discuss the use of ultraviolet in treatment of waters for control of diseases; the virus diseases and their control methods (IHN, IPN, whirling disease, and others). Engineering of hatcheries and fish farms, including practical systems of reusing water, also will be discussed.

For more information contact: Clay M. Robinson, U.S. Trout Farmers Assn., 67 West 9000 South, Sandy, Utah 84070.

GAME FISH MEETING CANCELLED

The Game Fish Research Conference of the International Oceanographic Foundation, scheduled for Curacao, Nov. 13-14, 1970, has been cancelled.

BCF CONTINUES WHALE RESEARCH PROGRAM

Although whales lost their economic importance years ago, they have not lost their popular appeal. To quiet rumors that Federal whale research would be curtailed, Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife and Parks, said BCF has never announced a reduction in funds or end of the program.

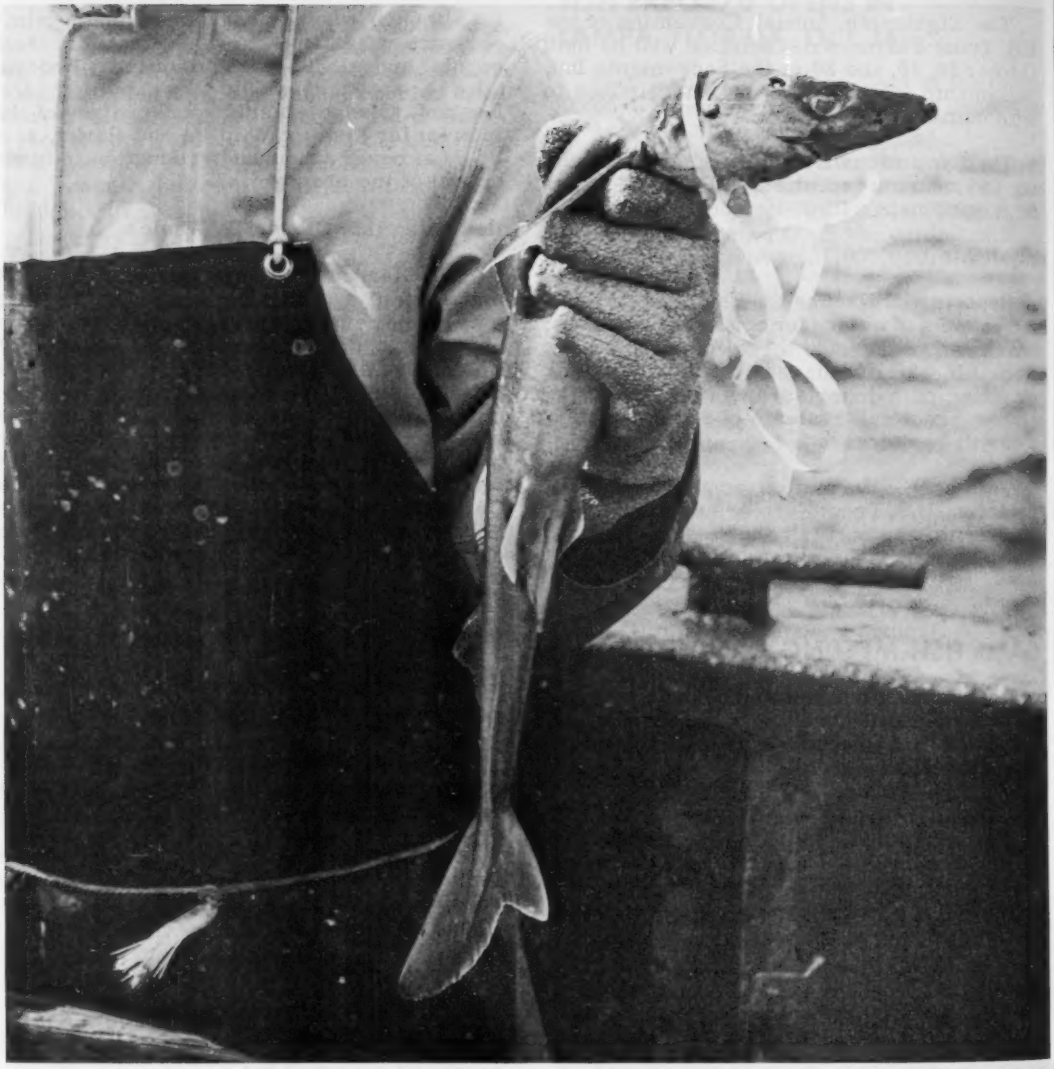
Has Scientists Closer To Whales

Dr. Glasgow stated: "In order to make better use of available funds, we are planning to relocate certain research activities, and to consolidate the scientific staff working with whales and other cetaceans. [Cetaceans are hairless, fish-like water mammals which include porpoises and dolphins, among other species.] Research on the gray whale population, which includes a yearly count of the whales as they migrate northward along the California coast, will continue. The program relocation would simply move the scientists closer to the whales they are studying."

CALIF. BANS COMMERCIAL FISHING OF PACIFIC MACKEREL FOR 2 YEARS

Gov. Reagan signed into law in August a bill banning the commercial fishing of Pacific mackerel for 2 years.

The bill was introduced to protect the dwindling Pacific mackerel resource from possible extinction.



A SIGN OF THE TIMES. The "ribbon" around neck of this dog fish was not won in competition. It is a plastic beer-can holder found on fish when it was removed from trawl net. (R. K. Brigham)

SALMON PLANT IN WILLAMETTE RIVER MAY BE LARGEST

The Oregon Fish Commission recently released into the Willamette River more than 10.5 million young fall chinook. It was another step in a 10-year program, which began in 1968, to develop the Willamette's potential for natural salmon production. It may have been the largest stocking effort of fed salmon ever undertaken within one state for that purpose.

Roy Sams, Commission project leader for Willamette Basin studies, said the young 3- to 4-inch fish are now well on their way to sea. They are destined to return as 3- and 4-year-old adults in 1972 and 1973.

Most unusual, the fish had not been reared in salmon hatcheries for all their juvenile freshwater cycle. Rather, they had been transferred from hatcheries to gravel borrow pits and a summer swimming pond at Cascades Gateway Park in Salem. Many more fish were reared in this way than could have been accommodated in existing hatchery facilities.

5% of Chinook Potential Utilized

Biologists believe that less than 5% of the fall chinook potential is being utilized--and that annual Pacific coast harvest of naturally produced Willamette River fall chinook could be multiplied.

The Commission believes this potential can be developed now because water-pollution control has been improved and many fish-passage problems corrected in the Willamette system. Oregon City's Willamette Falls, natural barrier to upstream migration, are main reason system is underutilized by fall chinook. This problem has been overcome as Fish Commission's $4 million Willamette Falls fishway nears completion. The funds were provided by Bureau of Commercial Fisheries and Portland General Electric.

Sams and others believe the quickest, most economical way to develop the natural spawning potential for fall chinook is to use inexpensive natural rearing ponds.

Pond Rearing Program

Sams said that this year over 12 million fall chinook, surplus to regular hatchery program needs, were available for the pond rearing program. "In early April, we stocked the four ponds at Salem, Stayton, and Aumsville with 2 to 5 million young weighing up to 600 to the pound. Then, for 8-10 weeks we fed them a commercially manufactured pellet diet at a cost of only $26,000." This is the largest part of the program's total cost.

During recent releases from the ponds, 85% of young chinook emigrated of their own choice, an excellent survival rate. The fish averaged about 100 to the pound.

The Commission hopes to increase the ponds' production level to 15 million a year for at least 8-10 years.

After the number of returning adults increases to the required level for adult spawning escapement, the pond rearing program could be discontinued. The run would perpetuate itself with little or no more expenditure. However, the ponds probably will be operated after developmental period because of their great value as production facilities.

LIGHTWEIGHT POTS ON LONGLINE EFFECTIVELY CATCH SABLEFISH

BCF's 'John N. Cobb' returned to Seattle on July 1 after a 12-day gear research cruise, in offshore waters off south-central Washington, during which technicians experimented with longline pot fishing for sablefish. They report: ". . .It is apparent that fishing lightweight pots on a longline is an effective method for taking sablefish."

Primary objective was to evaluate feasibility of fishing sablefish pots on longlines. Other objectives were to determine: optimum fishing distance between pots; suitable pot design for longline fishing; influence of soaking time on catch rates; and proper methods for handling pots and longlines aboard vessel.

GEAR AND METHODS

Pots and Longline Gear

Experimental pots of various designs and tunnel configurations were prepared to fish from longline gear. Most pots were constructed of 11-gauge, 2- by 4-inch, galvanized wire mesh and supported with $\frac{1}{2}$-inch mild steel rings and rungs. Most wire mesh pots were cylindrical, 6 to 10 feet long, 3 feet in diameter, with 8-inch tunnel openings and spring-tensioned triggers. Some pots had tunnel at one end; others had tunnels at each end. Several pots had experimental fyke tunnels. A few had 2 tunnels at one end to form double compartment. Five pots were rectangular, 40 by 30 inches by 8 feet, with tunnel at each end.

In addition to experimental wire mesh pots, 4 commercially designed and manufactured pots were evaluated. Two were plastic pots separated into halves and attached to webbed frame 40 inches square by 14 inches deep. These pots resembled a cloverleaf and had 4 openings. The remaining two pots were collapsible fyke-type nets with double tunnels at one end (two compartments) and completely webbed cod end.

The pots were fished from a 600-fathom longline (groundline) of $\frac{1}{2}$-inch, 6 by 19 galvanized wire cable. Stoppers formed by $\frac{1}{2}$-inch cable clamps were attached every 10 fathoms on groundline. One hundred fathoms at each end were free of stoppers.

Two Navy-type anchors, each 200 pounds, and 10 feet of anchor chain were used at each end of the groundline.

Buoylines, in 50-fathom coils, were $\frac{7}{8}$-inch, $\frac{3}{4}$-inch, and $\frac{5}{8}$-inch polypropylene and $\frac{1}{2}$-inch nylon. Two surface buoys, a pole marker, and a gill net light were used to mark each end of buoyline.

Setting and Hauling

Before setting gear, bottom was reconnoitered with echo sounder to determine depth and topography. Groundline was set from and hauled onto cable-towing winch drum from amidship on starboardside. An open-faced pursing block attached to a short boom extended outward and led groundline into winch. Groundline was transferred to and from anchor chain to a drum pendant using a short idler cable, flat links, and G-hooks. Pots were attached to groundline, when setting, with either a snap-on hook or $\frac{3}{8}$-inch shackle attached to gangion. The hauling operation was reverse of setting procedure, with exception that a hoist was used to lift pots aboard (see figures 1-6).

Area of Operation

Experimental fishing was conducted at two locations: 46°55' N.; 124°50' W. in 190-210 fathoms, and 46°49' N.; 124°54' W. in 175-200 fathoms. Three gear lifts were made at each.

RESULTS

Strong northwest winds offshore delayed operations, so only 6 sets were made. Catch results are summarized by pot type in table.

6 Experimental Sets Off Washington

Pot Type	No. Pot Hauls	Range of Catches Per Pot Lift Marketable Sablefish 1/	
		No.	Wt.
Cylindrical:			
2 tunnel, std.	20	0-42	0-231
1 tunnel, std.	20	1-25	5-137
1 tunnel, fyke	7	1-17	5-93
Double compartment	12	1-71	5-436
Rectangular	2	7-14	37-77
Cloverleaf, plastic, 4 tunnel	4	2-4	10-20
Fyke net, 4' x 12'	2	0	0
Total	67		

1/A marketable sablefish is longer than 17 inches from insertion of first dorsal fin to end of tail.

Fig. 1 - These pots on deck of John N. Cobb will be fished from a groundline.

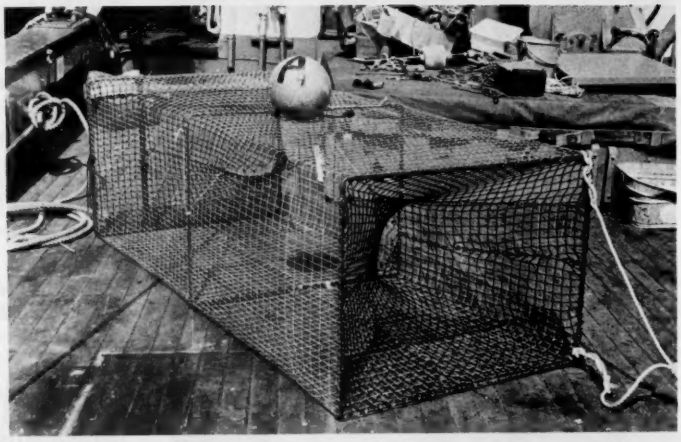


Fig. 2 - A rectangular pot built on deck.

Fig. 3 - Buoy line connected to anchor and groundline is wound on net reel.

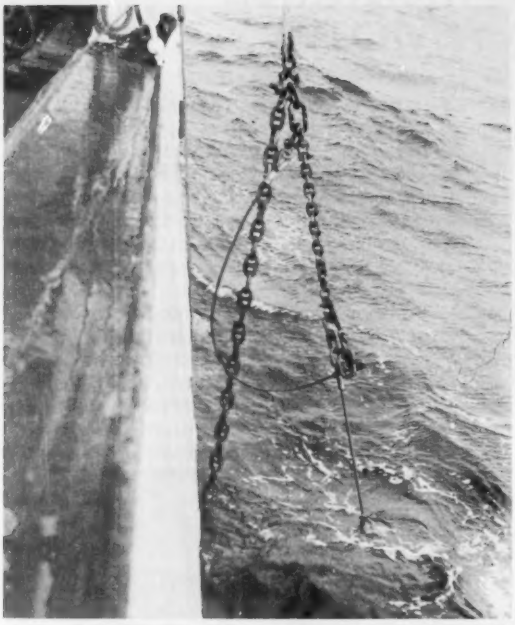


Fig. 4 - Groundline and anchor are held with buoy line until connected to pendant with idler cable.

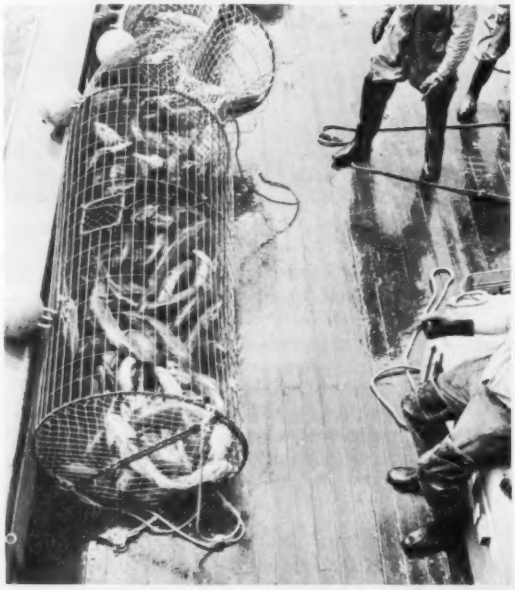


Fig. 6 - Largest fish catch made in double compartment pot--71 market-size sablefish; dressed weight of 436 pounds.

Fig. 5 - Pot coming out of water.

Soaking times ranged from 11 to 66 hours with best catches on longer soaks. Pots were spaced 10 to 30 fathoms apart on groundline--but no noticeable differences in catch rates could be detected due to pot spacing.

On first set, failure of snap-on hooks resulted in loss of 13 of 24 pots set. Later, all pots were fastened to groundline with $\frac{3}{8}$-inch shackles. No further losses occurred.

Fishing pots on longline was no problem. As expected, hauling time per pot was much better than experienced in past when fishing individually buoyed pots. The best record using longline gear was 18 pots hauled in 2 hours.

The BCF technicians concluded: "Although the lack of repetitive observations makes it difficult to make any conclusive statements regarding optimum soaking time, distance between pots or pot design, it is apparent that fishing lightweight pots on a longline is an effective method for taking sablefish.

"Averaging over the entire experiment, it appears that the double-compartmented pots outfished the other pots. The two largest catches, 240 and 436 pounds of marketable sablefish per lift, were made with this type of pot. The plastic cloverleaf-type and fyke net-type pots fished poorly or not at all."

For more information contact: A. T. Pruter, Acting Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Blvd. East, Seattle, Washington 98102 (Phone: 583-7729).

LAKE ERIE: COMMON EFFORT CAN SAVE IT

The Nation's greatest freshwater resource, the Great Lakes, is seriously threatened. "Accelerated enrichment, unabated pollution, overexploitation, and introductions of exotic species, have all been guided--more often misguided--by man." Of all 5 Great Lakes, Lake Erie is most damaged and most threatened. This evaluation was part of a statement by BCF Ann Arbor, Mich., to the Lake Erie Enforcement Conference in Detroit, Mich., on June 3. It was delivered by Dr. Wilbur L. Hartman, Investigation Chief, Lower Great Lakes Program.

For over 100 years, Lake Erie has supported a commercial fishery. Even today, more than 50 million pounds of fishes are landed each year by U.S. and Canadian fishermen. This is comparable to levels of past half-century. In the last decade, the U.S. sport fishery has increased tremendously. These combined U.S. and Canadian fisheries in Lake Erie, nearly 70 million pounds, are worth nearly $5,000,000 today. When thousands of pleasure boats are included, capital investment in gear for these fisheries reaches hundreds of millions of dollars.

Shift to Cheaper Fishes

Unfortunately, the BCF Ann Arbor statement noted, "there has been a drastic shift in the commercial and sport harvest from high-value fishes to medium- and low-value fishes." The fisheries for lake trout, northern pike, blue pike, and sauger are memories. Sturgeon, whitefish, and ciscoes are nearly gone. Today, emphasis is on catching such medium-value fishes as yellow perch and white bass.

Many Changes in Lake Erie

Lake Erie is about 241 miles long; its maximum width is 57 miles.

Industrial, municipal, and agricultural pollution and enrichment have produced many changes in the living aquatic resources and environment: "massive nuisance and toxic algal blooms of Microcystis and Aphanizomenon, destruction of the valuable mayfly benthos in the western and central basins, a 20-fold increase in plankton, which is the diet staple for several nuisance and low-value fishes that have undergone population explosions in the last 15 years, increased levels of such pesticides as DDT and Dieldrin in fish flesh, dangerously high levels of mercury in many fishes, the destruction of spawning areas of some of our most valuable fishes, and disappearance of oxygen from the bottom waters of the central basin during the summer."

The statement warned: "Unless major action is taken immediately to remedy the deleterious activities of man, Lake Erie tomorrow will have very few walleyes, an unhealthy yellow perch population, increasingly larger populations of low-value fishes such as carp, goldfish, suckers, freshwater drum (sheepshead) and alewives. Without effective action, Lake Erie tomorrow will have increased fish kills, smothering algal blooms, greater bacterial contamination, and more extensive oxygen depletion. The quality of the water so desperately needed to supply a broad spectrum of users will continue to deteriorate."

Water Chemistry

About 40 billion gallons of untreated municipal sewage and many billion gallons more of partially treated sewage are dumped into Lake Erie each year. An estimated 137,000 pounds of phosphorous enter Lake Erie each day--72% from municipal waters. So nutrient levels have increased substantially.

Total dissolved solids have increased over 50 parts per million (ppm) during past 50 years. These increases alone have not directly killed fish, "yet they reflect the changes man has wrought, and have serious indirect effects. . . .The latest data on Lake Erie water chemistry shows no significant deacceleration of these rates of increase."

Organic Production

Generally warm water temperatures, increasing slightly over the years, are 2° F. warmer on average since 1920 due to climate changes. This and tremendous increases in nutrient levels have produced dramatic increases in organic production, particularly

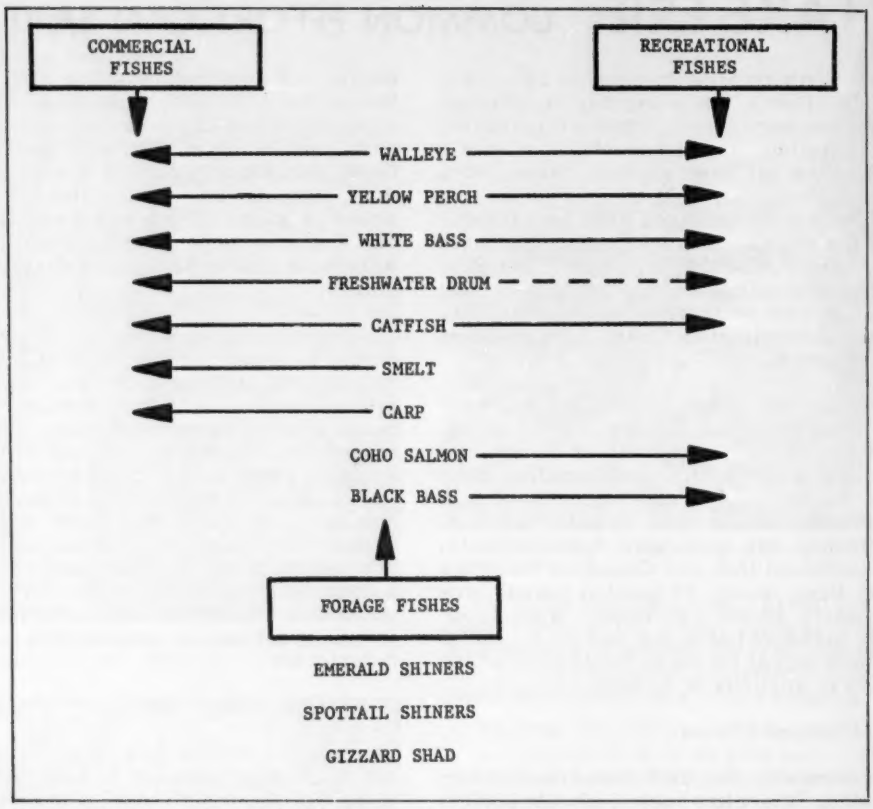


Fig. 1 - The fish resource of Lake Erie is a complex biological system involving predator fish-walleye; forage fish--emerald shiners; competitor fish--yellow perch and freshwater drum; parasitic fish--sea lamprey; and fish that seriously disturb the environment--carp.

at algal level. Over the past 50 years, plankton algae have increased 20-fold. The growths of filamentous algae, such as Cladophora, have boomed. These are a nuisance along Lake Erie's shores. Millions of tax dollars have been lost because property has been devalued.

The composition of the plankton algae has changed adversely. "The noxious blue-green algaes, Microcystis and Aphanizomenon, have recently become dominant summer species. In 1969, the late summer blooms of these forms in the western basin were unusually and unbelievably dense and widespread."

Oxygen Levels

Organic production directly affects oxygen regime in Lake Erie. The fallout of dead algae sinking through water column to bottom creates a tremendous biological-oxygen-demand (BOD) during decomposition. The greater the organic production, the greater the BOD.

Thermal Conditions

The waters of Lake Erie undergo considerable thermal change each season. During severe winters, 95% may be ice covered. Summer surface temperatures exceed 75° F. each year.

At present, Lake Erie is about 2° F. warmer than during early 1920s. Between 1925 and 1930, the greatest increase in mean annual air and water temperatures occurred.

The oxygen regime has been seriously degraded. During thermal stratification, the sediments and bottom waters become isolated

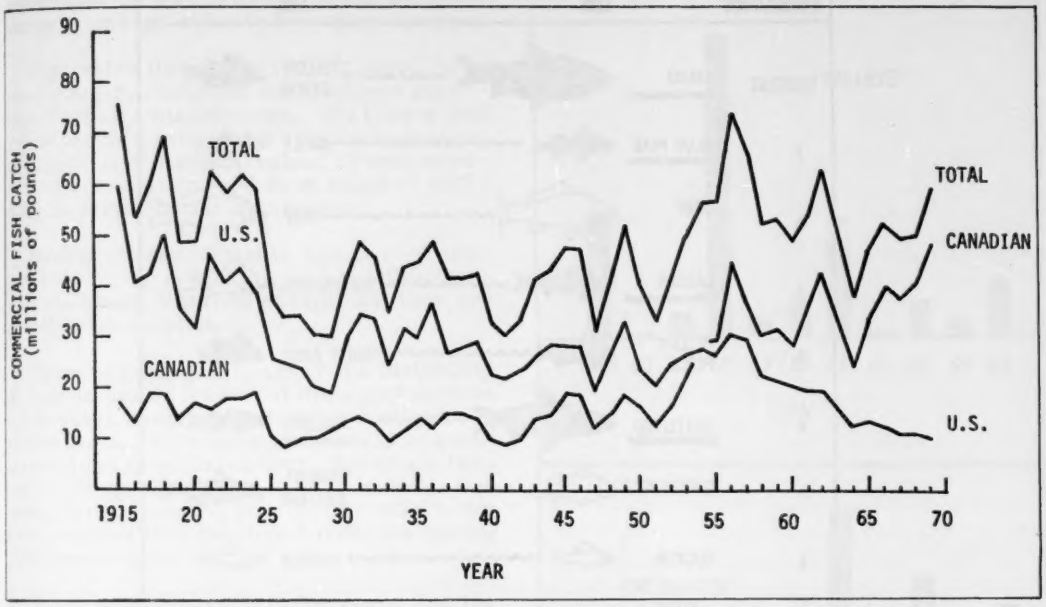


Fig. 2 - The commercial catch of Lake Erie fish has averaged 50 million pounds since 1915. Before 1954, U.S. fishermen landed most of the catch. Now Canadian fishermen reap the harvest and U.S. landings are at an all-time low.

from overlying surface waters. Oxygen lost in bottom waters cannot be replenished adequately until stratification breaks down and a mixing with oxygen-charged surface waters occurs.

Increased organic production and introduction of reduced, oxygen-demanding organic and inorganic materials have resulted in deterioration of oxygen levels in many areas of Lake Erie.

Bottom Organisms

Degradation of the oxygen regime has altered dramatically the populations of bottom organisms essential as food to certain valuable fish. Since 1953, this phenomenon has reduced mayfly larvae (Hexagenia) from 400 to 10 individuals per square meter and, in places, entirely eliminated them. It has "increased the numbers and distribution of sludge worms (oligochaetes) many-fold, reduced caddisfly larvae almost to the vanishing point, favored large increases in the populations of low oxygen tolerant forms of midges, reduced the non-tolerant forms, caused an increase in some species of fingernail clams, and generally reduced the numbers of all pollution-sensitive bottom organisms."

The original community of organisms was an essential part of the food chain important to desirable fish. Changes in this community have adversely affected these fish and, in turn, the economics of the fishing industry. The narrow stratum in the bottom of Lake Erie, with its low dissolved oxygen content, "is so polluted that the future status of the entire lake as a useful producer of fishery products is uncertain."

Thermal Effluents

Nuclear power plants on Lake Erie are proliferating. BCF is concerned with potential bad effects of heated discharges on fishes and associated aquatic resources for these reasons:

1) A uniform increase of temperature will increase metabolic activities of organisms and result in increasingly greater levels of organic production. This would increase rates of BOD and degradation of oxygen regime.

2) The highly valuable walleye in western Lake Erie have separate spawning sites on shallow reefs. The spawning areas are shallow, 2 to 10 feet. The spawning and incubation physiologies of walleyes are such that large

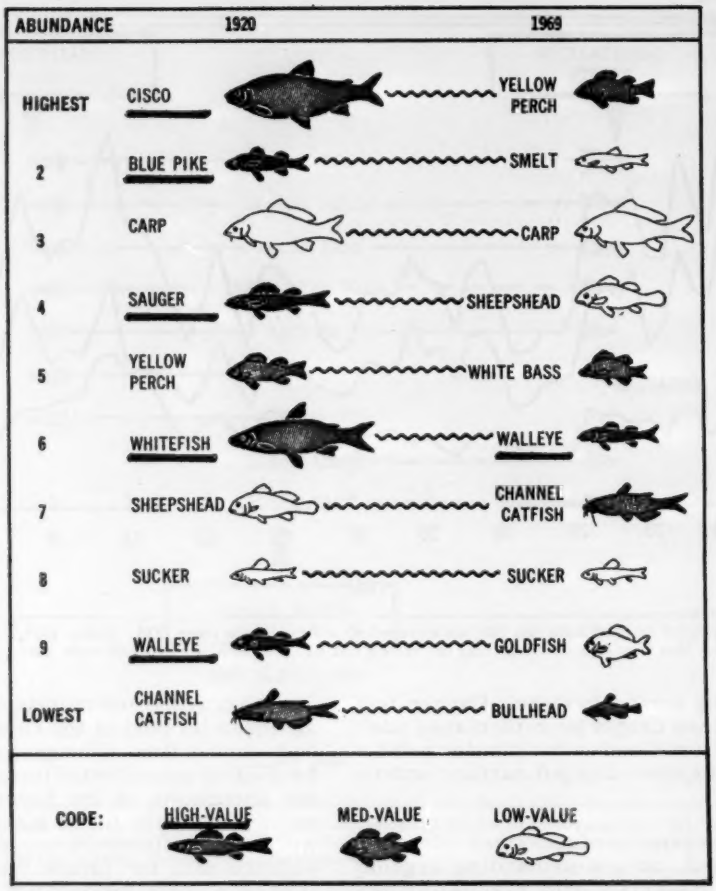


Fig. 3 - In 1920, the commercial catch from Lake Erie was dominated by five high-value fishes--cisco, blue pike, sugar, whitefish, and walleye. Now only the walleye is left, and it is in serious decline. The pressures of rapid environmental degradation and heavy exploitation have left us with a fishery resource composed only of medium and low-value fishes.

heated discharges would disrupt spawning severely and could destroy incubating eggs.

3) BCF data show that an increase in incubation temperatures from 10 to 15° C., for example, will decrease incubation period of walleyes from 20 to 10 days. Quite possibly, unnatural heating in areas where eggs are incubating would result in unnaturally earlier hatching when environment could be unsuitable to their survival. German scientists have demonstrated this for reduction of whitefish in Lake Constance, Switzerland.

There should be no significant additional thermal inputs into Lake Erie, especially into western basin, under possible consequences have been assessed.

Fishery Resources

Of all Great Lakes, Lake Erie has been most fertile and productive in pounds of fish. Nineteen species have been significant in the landings at some time. Annual combined U.S. and Canadian production, which has fluctuated little in the past 50 years, has averaged about 50 million pounds.

Lake Erie fish production, on a poundage basis, continues to maintain itself. However,

catch value is declining, which reflects change from high-value to low-value species.

High-value fishes--whitefish, cisco, blue pike, sauger, sturgeon, and northern pike--have virtually disappeared. Walleye and yellow perch are the major remaining species of higher and medium value. These populations are declining and show signs of difficulty in perpetuating themselves.

Stocks of less valuable species--freshwater drum, carp, suckers, and goldfish--are still abundant. With few exceptions, they are greatly underexploited.

There is great concern over the instability of year-class success and the sharp decline for western basin populations of walleye and yellow perch, the two most important to commercial and sport fishermen. Not since 1965 has either species spawned successfully, despite a large spawning population available for each species that developed from the strong 1965 year-class.

Some people have felt for years that the decline and disappearance of so many valuable species from Lake Erie were due to overexploitation. "Actually, the combination of overexploitation, environmental degradation, and the introduction (accidental or otherwise) of exotic fishes such as sea lamprey, carp, and goldfish have all contributed together in some measure over the years to cause changes in the abundance of our valuable species. Yet the decline of the walleye and yellow perch today must be attributed in larger part to extensive deterioration of the environment. In this sense, the populations are in double jeopardy."

Research during the 1969 walleye spawning season tends to support BCF contentions that the degraded environment is a primary factor influencing the abundance of certain species in Lake Erie.

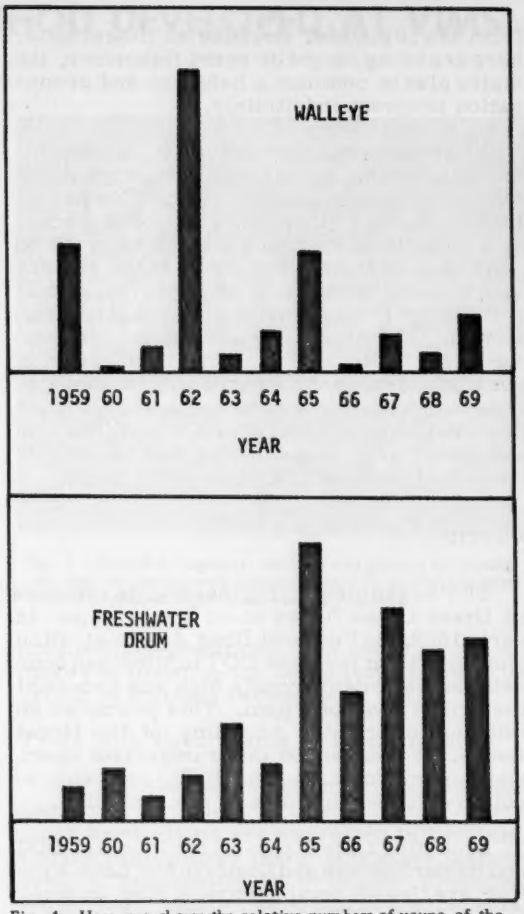


Fig. 4 - Here are shown the relative numbers of young-of-the-year walleye and freshwater drum (sheepshead) sampled with bottom trawls in Western Lake Erie at permanent index stations, 1959-69. The walleye, the last high value fish in Lake Erie, is in drastic decline with good hatches only every third or fourth year. Freshwater drum, on the other hand, are rapidly increasing in numbers and constitute a huge underutilized resource.

Introduction of Coho Salmon

Ever since 1870, researchers have stocked Lake Erie with several species of salmon fry. Their efforts failed. But the experimental introductions of yearling coho salmon in recent years appear successful. The newly coordinated coho program among the States began officially in spring 1968: 121,000 salmon were released in the tributary waters of Ohio, Pennsylvania, and New York. Plantings were continued in 1969 with the spring release of 230,000 yearlings and, again this spring, with another 545,000 fish. The technological advances over the past 15 years in raising coho salmon to yearling size (4-7 inches) have assured a better chance of success for current plantings.

These coho salmon reach adult size in the fall of the year following year of release. More often than not, they return to original release stream to spawn. Based on returns from 1968 stockings, the adults may range

from 4 to 10 pounds. Because sufficient numbers are being caught by sport fishermen, the States plan to continue a hatchery and propagation program indefinitely.

However, important research information on these stockings is meager. Estimates of harvest of coho from the original 1968 stocking were about 10%. These catches represent sportsmen's landings and returns to weirs on spawning streams. The commercial fishery is prohibited from taking this species. Additional data suggest cohos move slowly about lake in clockwise direction during season. Actually, their midsummer distribution is restricted to colder and still-oxygenated waters on north side of eastern basin. Further degradation of oxygen regime in eastern basin eventually may place limits on Lake Erie's capacity to support this coldwater form.

Insecticides

BCF began monitoring insecticide residues in Great Lakes fishes about 5 years ago. In early 1969, the Food and Drug Administration announced that levels of DDT in Michigan coho salmon were dangerously high and exceeded the action level of 5 ppm. This prompted an immediate broader sampling of the Great Lakes. It focused on more important sport and commercial fishes. BCF was able to obtain considerable data in a few months.

Excepting Lake Superior, the levels of DDT and its derivatives and Dieldrin for Lake Erie fish are lower comparatively than in other Great Lakes. They fall well under action level of 5 ppm. Nevertheless, the problem is serious. In the past few years, growing concern about DDT buildup in the environment has led to bans on sale of these pesticides in several states.

The Mercury Crisis

The most recent environmental crisis in Lake Erie is mercury contamination of fish. On March 25, 1970, Canadian officials announced that levels of mercury in walleye, northern pike, and other species taken from Lake St. Clair were considerably above the 0.5 ppm action level set by Canada's Food and Drug Directorate. Later, they banned taking of fish for any purpose from Lake St. Clair and its tributaries. Immediately, U.S. public health and resource agencies became concerned about Lake Erie. Sampling programs were initiated. Since then, several hundred fish samples from Lake Erie-St. Clair areas have been examined by Federal and State agencies. As more data became available on fish taken from U.S. waters of Lake Erie, Ohio, Michigan, and New York began varying fishing bans.

Preliminary data from BCF sampling in Lake Erie show following ranges in mercury levels for certain fish from the western basin (the FDA tolerance level is 0.5 ppm): yellow perch (0.2 to 0.5 ppm), coho salmon (0.2 to 1.0 ppm), carp (0.1 to 0.8 ppm), white bass (0.3 to 1.5 ppm), channel catfish (0.3 to 0.6 ppm), freshwater drum (0.1 to 1.0 ppm), and walleye (1.0 to 3.0 ppm). An inspection of fish analyses by FDA shows most of their values within these ranges. Also, predator fish show higher values than forage fish. There are very little data from the eastern basin, but the mercury levels there are somewhat lower.

The consequences of mercury contamination have been tremendous. Sport and commercial fisheries have suffered considerable economic losses.

Conclusion

The environmental problems of Lake Erie are complex and discouraging. "And we certainly are in for further crises." Yet, BCF hopes that mounting national concern over fate of environment will generate greater urgency and support for all programs aimed at reducing degradation of Lake Erie's environment and its aquatic living resources. "Lake Erie is not dead. It can be saved if we all work together."

HARD-CLAM CULTURE METHOD DEVELOPED AT VIMS

A method of protecting hard-clam seed from natural enemies has been devised by scientists of the Virginia Institute of Marine Science (VIMS). "Aggregates"--shell, gravel, or other materials--are spread over sand or mud bottoms before planting seed. The aggregates protect seed clams from predators.

VIMS states: "Predators destroy nearly all unprotected clams smaller than one inch. The blue crab is the major predator in Virginia waters. Other crabs, boring snails, bottom-dwelling fish and waterfowl also take many clams. The hard clam (quahog) requires moderately high-salinity waters where these predators abound and often prevent natural reproduction from being successful."

Past Methods

In the past, experimental methods of protection included planting clams in screened trays or boxes; within fenced enclosures; under sheets of netting or hardware cloth; in saltwater ponds or tanks; and intertidally. However, reports VIMS, "these techniques are unreliable, expensive and cause silting and slow growth." So they have not been suitable for commercial use.

Spreading Aggregate

Scattering aggregate over bottoms or clam beds is a simple procedure. VIMS scientists believe that increased yields soon will pay initial cost of aggregate. There is no maintenance. The Maryland hydraulic escalator clam harvester automatically deposits buried shell on surface; so, if buried shell is available, harvesting clams will prepare beds for planting.

Besides boosting production from commercial beds, the new technique promises to encourage operations of clam hatcheries. Several now operate experimentally on Eastern Shore of Virginia, and elsewhere. VIMS states: "Hatcheries can offer an almost limitless supply of seed clams from selected, fast-growing parents. A major obstacle has been growing seed clams to usable size after they have been reared to setting. Holding millions of young clams in trays to avoid predators requires expensive handling, feeding, and cleaning operations. The use of aggregate makes it possible for these tiny clams to be grown on bottoms instead of in trays."

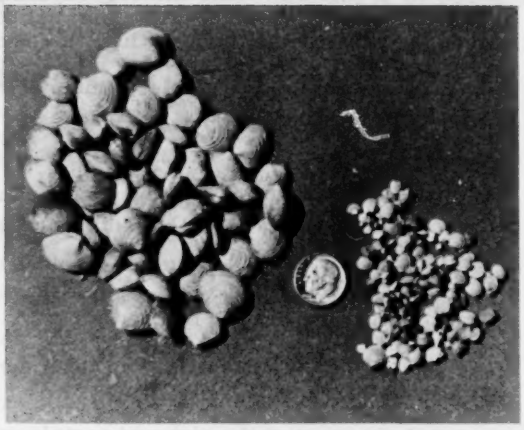


Fig. 1 - On left is fingernail size seed now planted by industry. On right is match-head size seed reared by hatcheries; these could be planted if protected with aggregate.

Tests With Hard Clams on Eastern Shore

In April 1967, experiments with aggregates began on seaside of Eastern Shore, where most hard clams are harvested in Virginia. During preliminary tests, scientists discovered 3 aggregates successfully protected small hard clams (Mercenaria mercenaria, also called Venus mercenaria). The three were: 1) crushed oyster shell, 2) crushed stone (as used in road building), and 3) stream bed gravel (sold as pea gravel).

An average of over 80% of the seed clams planted on these covers survived seasons when blue crab and other predators were most active. In two tests, more than 90% of the clams lived. In control plots, where clams were planted without aggregate protection, survival was about 16% but never over 30%.

Young clams of various sizes were grown in the VIMS Wachapreague Laboratory to serve as test animals. These ranged from $\frac{1}{25}$ to 1 inch--between extremely small seed not used by industry to fingernail size seed now planted.

Clams larger than match-head size survived best. Smaller clams, too mobile, would leave protection of aggregate and become exposed to predators. This moving, explains VIMS, is possible because the clam, unlike oyster, retains its foot after setting. In some tests, however, even clams as small as $\frac{1}{25}$ to $\frac{1}{5}$ inch survived in acceptable numbers in some plantings.

VIMS Recommendations

VIMS offers these suggestions to clammers wishing to start trial plantings with aggregates.

1. Select cheap and plentiful aggregates. Almost any aggregate can be used.

2. Before buying in bulk, test to see if aggregate particles are:

   a. heavy enough to sink and remain on bottom.

   b. small enough to pack well

3. Spread aggregate 1- to 3-inches thick over clam-planting area when using coarse materials (uncrushed shell), and one to two inches when using fine materials (pea gravel, crushed stone, or crushed shell). Level aggregate by dragging 4-ft. section of cyclone-type fencing over area.

Fig. 2 - Three aggregates that successfully protected small clams from predators. Top left, crushed oyster shell. Top right, pea gravel. Bottom, crushed stone.

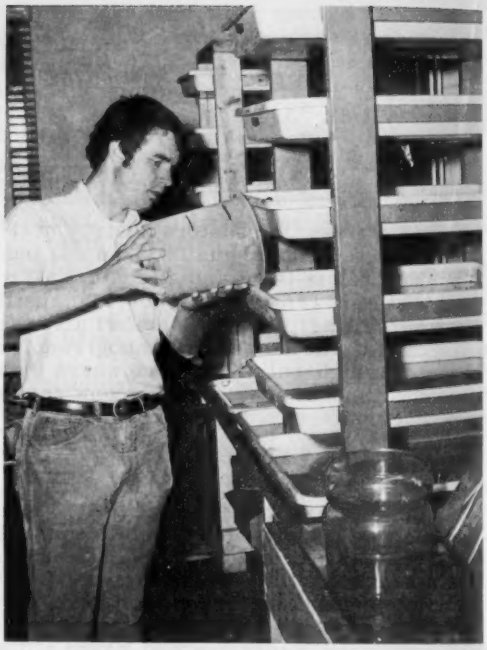


Fig. 3 - Young clams of various sizes were grown in VIMS Washapreaque Laboratory to serve as test animals in experiments with aggregates. Many trays of clam larvae were spawned, cultured, and maintained by VIMS scientists and technicians.

4. Scatter seed clams evenly over aggregate at rate of about 25 to 50 per sq. ft. The clams will burrow through aggregate and into bottom. It is important that you do not overplant because crowded clams will move away from each other--and possibly out of protected area. If too crowded, they will not grow as fast because of competition for food and space.

5. Aggregate can be put on bottoms any time. Clams should be planted when active--when water temperature is 48° F. or higher. Clams will burrow under aggregate in short time at higher temperatures. Plant at slack tide to avoid excessive clumping or scattering of clams.

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RADIOECOLOGY: NEW TOOLS YIELD ANSWERS TO OLD PROBLEMS

Gary Milburn

Radioactivity is not new to our planet. It has been here since the earth was formed. Manmade radioactivity, in the form of nuclear fallout, appeared 25 years ago when the first atomic bomb exploded. In the northern hemisphere, about 60 percent of this radioactive material falls into the ocean (about 60 percent of the earth's surface in our hemisphere is covered with water). Additional fallout is leached from the soil and carried by rivers to estuaries and the ocean.

More recently, as man has learned to use atomic energy for peaceful means, radioactivity has become a waste product of nuclear power plants, and nuclear fuel production plants. Although the radioactive wastes from nuclear power plants are very carefully controlled, some radioactivity is released into the rivers that supply the water required by the reactors. For example, the Hanford Atomic Production Plant in Washington State releases radioactivity directly into the Columbia River. Much of this radioactivity is carried to the Pacific Ocean 350 miles downstream.

This radioactivity, whether from fallout or from reactor effluents, eventually enters the marine environment, where it is cycled continuously through sediments, water, plants, and animals. What happens to these materials? Are they accumulated by fish or other animals to a level that might be harmful to the animal or to man?

BCF Beaufort Research

To answer these and other questions, scientists at the BCF National Center for Estuarine and Menhaden Research, Beaufort, North Carolina, directed by Dr. Ted Rice, are studying the movements of these radioactive materials in the estuarine environment. The purpose of their research is twofold: (1) to determine the fate of radioactive elements released into the estuarine environment and the effect of this radioactivity on estuarine plants and animals, and (2) to develop and apply radioisotopic methods to studies of estuarine ecology. The laboratory also evaluates the radio-biological effects of the construction and operation of nuclear reactors on fishery resources. The work is jointly sponsored by BCF and Atomic Energy Commission.

Emphasis is placed on estuarine areas because fishery scientists have found that the bays, sounds, and associated nearshore areas that surround our coasts are among the world's most productive areas. Estuaries provide essential living space for more than 70 kinds of fish and shellfish that contribute 3 billion pounds, or two-thirds, of the total U.S. commercial fishing catch. Seven of the ten species most in demand, including shrimp, our most valuable fishery, and menhaden, our largest fishery, must have suitable estuarine nurseries.

The author is staff writer/editor, BCF National Marketing Services Office, 100 E. Ohio St., Rm. 526, Chicago, Illinois 60611.

Radioecology

Dr. Thomas Duke, chief of BCF's Pesticide Field Station, Gulf Breeze, Florida, explains: "The study of radioactivity in our environment and the use of radioisotopes in ecological studies is called 'radioecology'. The term is composed of two words, 'radio' which refers to radioactivity, and 'ecology' which is derived from the Greek 'Oikos', meaning 'house' or 'place to live'." Ecology is usually defined as the study of plants, animals, and other organisms and their relationship to their environment.

Research Results

The scientists have found that some organisms are 'biological indicators' of radioactivity in the environment because of their affinity for certain elements. For example, oysters accumulate zinc 65; scallops, manganese 54; clams and mussels, cerium 144; and tuna, iron 55. The oyster concentrates zinc to about 100,000 times its normal concentration in sea water. Because of the oyster's ability to concentrate radioactive elements, scientists were able to detect increased levels of radioactivity in oysters within 8-12 days after the Chinese nuclear tests!

Radioactive elements act essentially the same as their nonradioactive counterparts when released into the marine environment. Therefore, if radioisotopes are present in the environment, the organisms will be unable to distinguish them from nonradioactive forms, and the radioisotopes will be accumulated also.

Whither Radioactive Elements?

The fate of radioactive elements in the estuarine environment depends upon the route they take. Radioactive elements can remain in solution or settle to the bottom. Laboratory studies have shown that organisms accumulate radioactivity in different way: plants accumulate radioactivity directly from water; clams and oysters by feeding on suspended material that contains radioactivity; large fish, such as tuna, by feeding on other animals that are radioactive. Thus, radioactive elements are detectable in marine organisms, even though their concentrations in sea water are generally too low to measure.

Effects On Organisms

How do these radioactive accumulations affect these organisms? To determine the effects of radioactivity on the body chemistry and shapes of plants and animals, BCF scientists began carefully controlled experiments. They found that radiation interacts with salinity and temperature to affect survival, growth, and body shape of estuarine organisms. In one experiment, brine shrimp exposed to low-level radiation grew faster, were more uniform in size, and reached sexual maturity more quickly than those not exposed to radiation. In another study, young fish exposed to low-level radiation were longer and deeper bodied than those exposed to more radiation or to no radiation. Low levels of radiation actually made these animals healthier and bigger!

Further studies showed that many estuarine organisms, such as clams and oysters, could tolerate extremely high doses of radiation. The fatal radiation dose for oysters was approximately 300 times the fatal dose for white mice. The fatal dose for clams was 220 times that for white mice. Mammals (including man) are much more sensitive to

radiation than most estuarine organisms. Therefore, it is generally assumed that so long as environmental radioactivity is safe for man, other animals will not be endangered.

Other Uses for Radioisotopes

In the course of their work, the scientists found other uses for radioisotopes. These isotopes (tracers) have been particularly valuable in studying the food and feeding habits of clams and oysters. Says Dr. Duke: "Before radioisotopes became available, it was difficult and time consuming to compare the suitability of different kinds of phytoplankton (minute plants that float in water) as food for oysters and clams. Some of the plants consumed by these animals are used for nutrition. Others are quickly discarded without being used. To test the nutritive value of different types of phytoplankton, these plants are labeled with radioactive elements and then fed to oysters and clams. After several hours the animals are dissected. The muscles that control the opening and closing of the shell are removed and analyzed for radioactivity. If radioactivity from the labelled plants appears in the muscle, then the phytoplankton was presumably used for nutrition by the animal."

Many of the experiments were done on animals held in the laboratory. Dr. Duke adds: "To better understand how radioactive materials move through the aquatic ecosystem, experiments ideally should be conducted in the natural environment, such as a sound or bay. For obvious reasons, however, the natural environment cannot be made radioactive for such studies."

To avoid contaminating the environment, experiments are conducted in a 40 by 60 foot salt-water pond in which a marine habitat is simulated. Several kinds of fish, crabs, and marsh grasses, along with oysters, clams, and snails, are placed in the pond. By introducing certain radiosotopes and using sensitive instruments, scientists can follow these materials as they are carried throughout the pond.

In one experiment, DDT, labeled with radioactive carbon, was traced through several steps in the food chain. Such studies enable scientists to explain how DDT moves in the aquatic environment and how organisms acquire DDT concentrations.

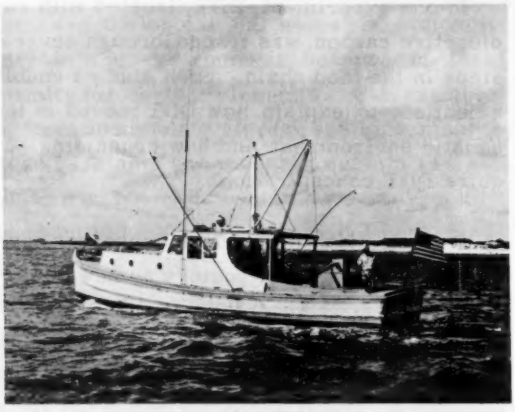
The scientists discover new research possibilities in the field of ecology as new radioactive materials become available. Instruments that measure radioactivity are highly sensitive. The application of radioactive tracers to problems beyond the range of standard methods has been possible.

BCF scientists are aware that radioecological studies will become more important as radioactivity in our environment increases.

BCF'S CENTER FOR ESTUARINE AND MENHADEN RESEARCH

A 1968 reorganization combined BCF's Biological Laboratory at Gulf Breeze, Fla., and Radiobiological Laboratory at Beaufort, N.C. The title of the combined labs was the National Center for Estuarine Research. In 1969, another reorganization combined the National Center for Estuarine Research with the Beaufort Biological Laboratory creating the Center for Estuarine and Menhaden Research.

The Gulf Breeze Laboratory was concerned with pesticides and the Beaufort Laboratory with radioactivity. The consolidation of the 2 labs strengthened research and facilitated solving problems on estuarine pollution, since radioactive material and pesticides have similar effects on some plants and animals.



This boat catches and transports live animals to the laboratory.

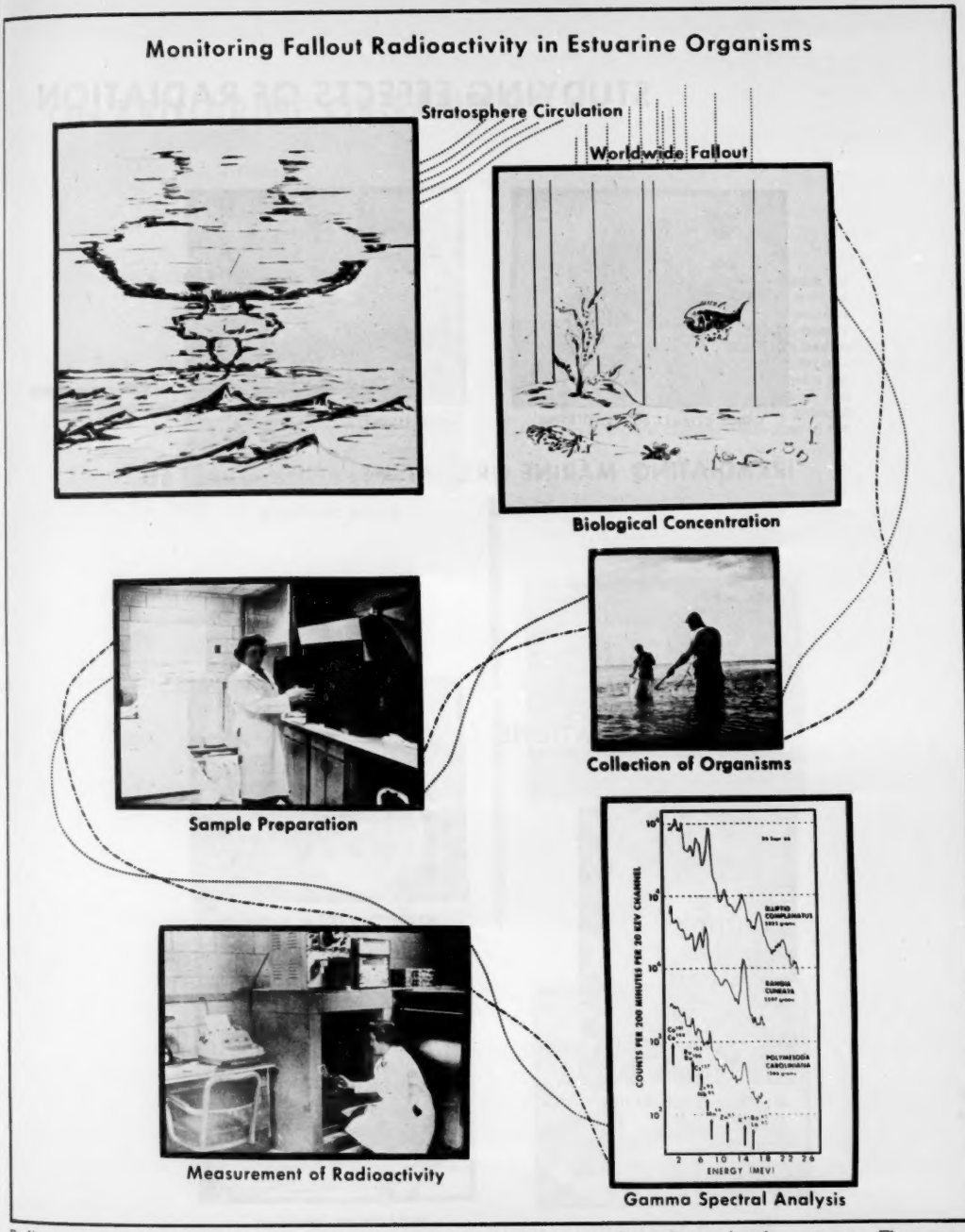
Research of the Center is concerned with: (1) fate of radioactive materials and pesticides in estuarine environment, (2) effect of radiation and pesticides on marine organisms, (3) application of radioactive tracer techniques to fishery biology, (4) effects of pesticides on the ability of marine organisms to survive, grow, and produce, and (5) cycling pesticides through water sediments and food chains of the estuary.

These approaches are used to tackle the problems of radiation at the Beaufort Lab: (1) data are collected in the lab to predict the fate of radioactive materials, (2) tanks and ponds are used to test questionable findings obtained in the lab, and (3) cycling of radioisotopes is observed in certain natural bodies of water, restricted from the public. The Laboratory believes that data collected by these three approaches, when integrated and correlated, make for a better understanding of the role of plants and animals in cycling of radioactivity in estuarines and marine areas.

Past significant accomplishments with pesticides by the Gulf Breeze Laboratory include: (1) determination of acute toxic effects of 200 formulations of pesticides on oysters and shrimp, and other organisms under controlled conditions in the laboratory. This information was passed on to the Pesticide Registration Board to assist them in labelling procedures. (2) Analysis of over 5,000 samples as part of nationwide monitoring program to determine levels of pesticides in fish and shellfish; (3) investigation of the effect of MIREX, a chemical used to control fire ants in the southeast, on estuarine organisms; and (4) discovery of occurrence of PCB (polychlorinated biphenyl) in seafood organisms in local area, located and stopped source.

The Center for Estuarine and Menhaden Research will lose the Gulf Breeze facility, if the President's reorganization plans become effective. The Lab will become part of an independent agency called the Environmental Protection Agency. (BCF Circulars 298 and 309.)

(See photo spread following pages.)



Radioactive materials are added to the estuarine environment through fallout from the explosion of nuclear weapons. These materials often are accumulated and concentrated by seafood organisms. As part of a program to study the biological concentration of fallout radioactivity by estuarine organisms, investigators collect organisms in the natural environment and take them to the laboratory for analysis. The amount and type of radioactivity in the organisms are measured with specially designed electronic equipment. The radioactivity content of some fresh-water and estuarine clams is shown in gamma spectral analyses.

STUDYING EFFECTS OF RADIATION

USING COBALT 60 IRRADIATOR

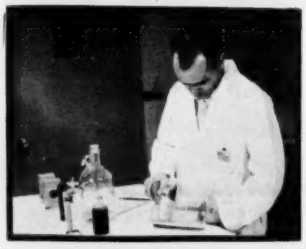
INSERTING FISH INTO IRRADIATOR

IRRADIATING MARINE ORGANISMS WITH COBALT 60

BIOCHEMICAL DETERMINATIONS

MEASURING TOTAL ELEMENT

MEASURING RESPIRATION



DETERMINING PROTEINS

ON ESTUARINE ORGANISMS

REMOVING BLOOD

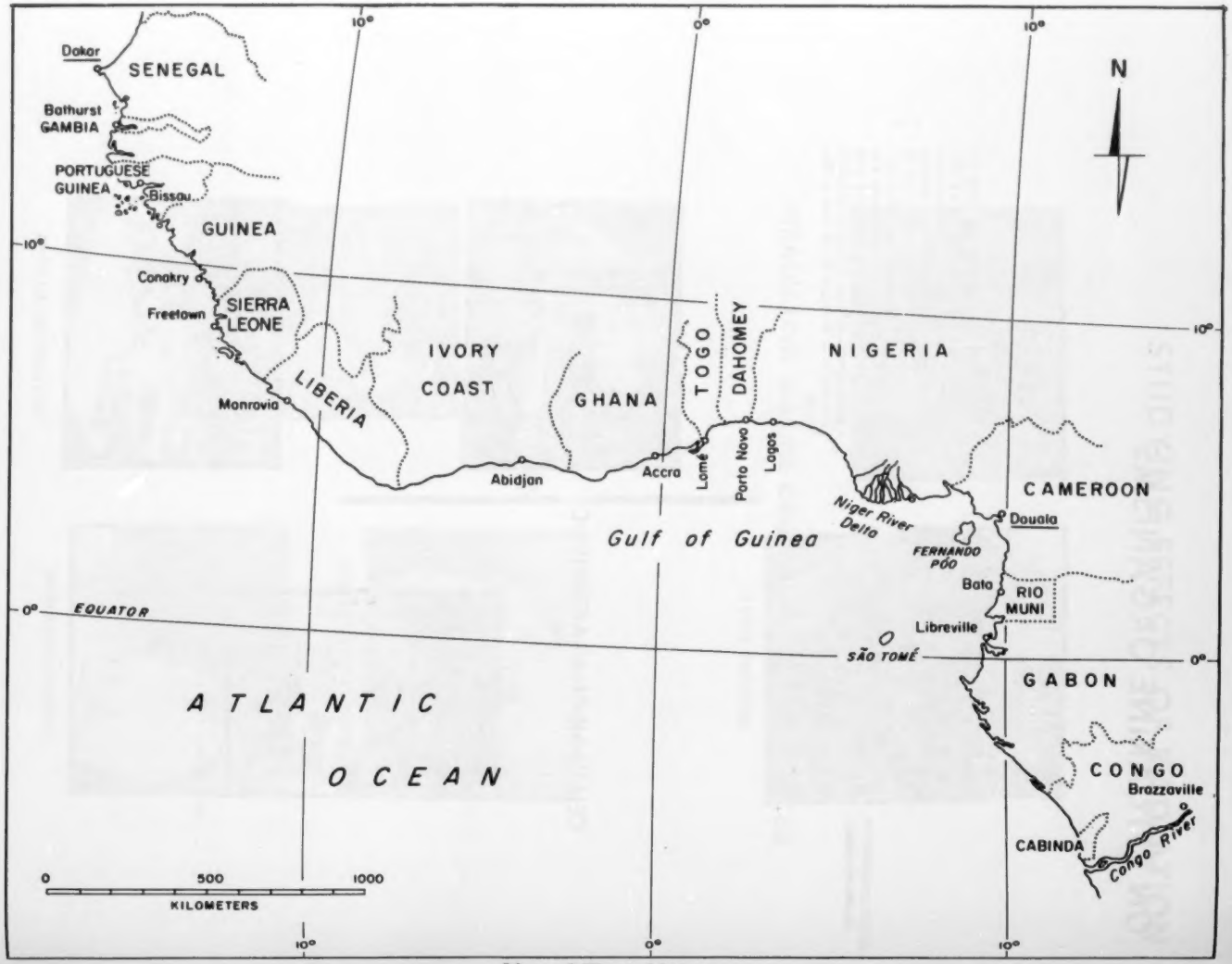
The effect of ionizing radiation on estuarine organisms is studied at the Radiobiological Laboratory. Organisms are exposed to gamma radiation from a cobalt 60 source which is contained in a specially built irradiator. After exposure to radiation, the organisms are subjected to various biochemical and cellular tests. Often, radiation-induced physiological changes occur first in the blood.

CELLULAR CHARACTERISTICS

COUNTING CELLS

MEASURING PACKED CELL VOLUMES

DETERMINING CELL TYPES



Map of West Africa.

THE COMMERCIAL SHRIMP POTENTIAL IN WEST AFRICA DAKAR TO DOUALA

Norman L. Pease

The increasing demand for shrimp for human consumption has created worldwide interest in using unexploited stocks. This interest is particularly evident in tropical and semitropical zones, where the right combination of environmental conditions can produce and support large populations of this highly prized crustacean. The West Coast of Africa is one such area.

Recently, countries in this area have become aware that they might have offshore shrimp resources that could be harvested to start a new industry. The African Development Bank (ADB), headquartered at Abidjan, Ivory Coast, is alert to these possibilities and has established a development program. ADB requested the Food and Agriculture Organization of the United Nations (FAO) Investment Center at Rome, Italy, to recruit someone to make a 3-month preliminary survey on the present knowledge about these shrimp resources.

The survey objectives were: (1) to ascertain biological information on shrimp from local research centers, (2) to determine the interest of existing commercial fishing companies in fishing for shrimp, and (3) to prepare an outline for a shrimp-resource survey. The writer made this survey during February-April 1969. This article was extracted from the report.

Marine research expanded in West Africa during the last decade. Most of it was directed toward implementing the harvest of finfish for local consumption; however, some shrimp research was conducted.

In 1966, Monod described shrimp species of West Africa and, in 1967, Crosnier, de Bondy, and Lefevre identified 11 species believed available in commercial quantities:

Penaeus (M.) kerathurus (Forskal)
Parapenaeopsis atlantica Balss
Penaeus (M.) duorarum notialis Perez Farfante
Parapenaeus longirostris (Lucas)
Solenocera membranacea (Risso)
Plesionika williamsi Forest
Plesionika martia (A. Milne Edwards)
Aristeus varidens Holthius
Plesiopenaeus edwardsianus (Johnson)
Glyphus marsupialis Fihol
Parapandalus narval (Fabricius)

Mr. Pease is Supervisory Fishery Biologist, BCF Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi 39567.
Contribution No. 211.

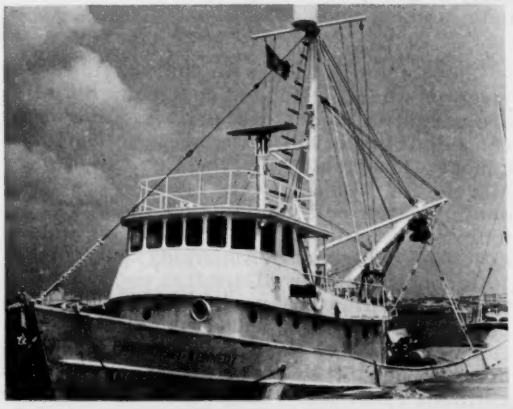


Fig. 1 - The 'President Kennedy,' a training and research vessel built in U.S. for Ivory Coast, at dock in Abidjan. It was a joint Ivoirian-US AID enterprise. It is being used now in an FAO sardine project.

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Fish and Wildlife Service
Reprint No. 882

The first three species are found primarily within 50-fathom depth range; the other 8 between 50 and 400 fathoms.

FISHING CRAFT AND FISHERMEN

Throughout the world's tropical zone, natives traditionally use dugout canoes for fishing. In West Africa, canoe fishing employs many people and is important to the local economy. The canoes used in the marine fisheries are 25 to 50 feet long, cost $50 to $100 each, are made usually of soft wood because of its buoyant quality, and have an average useful life of about $1\frac{1}{2}$ to 2 years. Outboard motors have been introduced but, because of their cost, are beyond the reach of most fishermen, who depend on a combination of sails and paddles.

An example of this fishery has been compiled by the Nigerian Federal Fisheries Service in a study of a typical coastal village of about 1,000 inhabitants. Of about 300 adult men, 280 are all-season fishermen. During the dry season, January to May, about 80 additional fishermen are attracted to the village from the neighboring countryside because of the high prices paid for fishery products. Working from this village are 180 canoes, usually two men to a canoe. They use a variety of gear, including cast nets, traps, set nets, seines, and hooks.

Most of their effort is for finfish. However, juvenile shrimp (Penaeus duorarum notialis) are caught in the estuaries during nocturnal ebb tides by a net stretched between anchored canoes. The most productive fishing is during March and April, when the average daily shrimp catch per canoe is about 50 pounds. (Shrimp weights given are heads on, unless specified otherwise.) Assuming that at least 100 canoes from the village fish each day, the total shrimp catch would be about 2.5 tons per day during the peak production period. During the rainy season, the shrimp catch decreases, but the Federal Fisheries Service estimates that this village catches about 400 tons of shrimp per year. When this catch is multiplied by numerous similar villages throughout West Africa, the combined catch of juvenile shrimp must be impressive.

Fig. 2 - A pompanolike fish, Lichia sp., on sale in Abidjan, Ivory Coast. In 90° F. and above temperatures, and refrigeration or ice lacking, fresh fish must be sold quickly.

Spaniards Fishing Since 1950s

A Spanish fishing fleet has been dragging off West Africa for deepwater species of shrimp since the early 1950s. Parapenaeus longirostris and Plesiopenaeus edwardsianus are the major part of its catch. The vessels are 100 to 170 feet long, powered by 600- to 900-horsepower diesel engines, have freezing capacity of 45 to 180 tons, and usually carry 20 to 30 men. Shrimp trawls of Spanish design, with footrope lengths between 197 and 310 feet are used; however, catch rate does not increase in direct proportion to increase in footrope length. The best depth range for dragging varies between species, and between seasons of the year. Variations in catch rate have been observed between day and night drags and phases of the moon. Dragging normally is carried out round the clock; individual drags last between 3 and 5 hours (table). The vessels stay on the shrimp grounds 7 to 9 months and, approximately once a month, are supplied by a vessel from Spain, to which they transfer their catch.

Catch Data from a Spanish Shrimp Vessel

Date	Drag Began	Drag Ended	Depth Fished	Catch of Heads-on Shrimp		Catch per Hour	
1968			Fathoms	kg.	lb.	kg.	lb.
12/19	0500	0930	136	235	517	52	114
"	1030	1430	136	250	550	62	136
"	1515	1900	136	154	339	40	88
12/20	0500	0945	140	231	508	48	105
"	1030	1330	140	190	418	63	138
"	1445	1830	140	150	330	40	88
12/21	0500	0900	130	150	330	37	81
"	0945	1445	130	150	330	30	66
12/22	0400	0830	210	300	660	66	149
"	1100	1600	210	250	550	50	110
"	1630	2030	210	275	605	68	150
"	2100	0200	210	300	660	60	132
12/23	0515	0915	120	200	440	50	110
"	1030	1430	120	250	550	62	136
"	1510	1910	120	300	660	75	165
"	2100	2400	120	300	660	100	220
12/24	0600	1000	212	375	825	93	215
"	1030	1430	210	450	990	112	246
"	1500	1900	210	400	880	100	220
"	2100	0100	210	350	770	87	191
12/25	0500	0900	212	400	880	100	220
"	0930	1430	212	450	990	90	198
"	1500	1915	210	300	660	70	169
"	2000	2400	210	250	550	62	136

SHRIMPING BY SOME WEST AFRICAN COUNTRIES

During the survey, I visited 8 countries and discussed shrimp resources with personnel of either national or international research organizations. I talked to owners, managers, and captains about local commercial fishing. They helped compile the following information.

SENEGAL

Commercial fishing for shrimp is more developed in French-speaking Senegal than in any other West African country. Its total coastline is about 275 miles. (All distances are given in nautical miles.) Its Continental Shelf is 10 to 50 miles wide. In 1967, shrimp production was 1.9 thousand short tons.

An organized canoe fishery has flourished since 1960, when 120 tons of young estuarine shrimp were produced for export. By 1968, this catch had increased to nearly 900 tons. Most of this production comes from the Casamance River system, which has nearly 1,000 fishermen at the height of the season. The Saloum and Senegal river systems contribute to this production. The fishery is active all year, but May through July is the peak production period.

Shrimp catches in offshore waters for adult Penaeus duorarum notialis began incidental to fish catches in 1963. For the next few years, several trawlers spent part of the year catching shrimp exclusively. Trawlers designed for shrimping began to appear in 1967; 28 vessels were shrimping actively in 1968. They work primarily in two areas off the coast--Dakar north to St. Louis, and Dakar south to Cape Roxo.

North of Dakar, shrimping is conducted on mud bottom in 15 to 40 fathoms. The normal season begins in November and ends in April or May. Catch rates in 1966-67 season averaged 350 to 750 pounds per day. Some high-line vessels were able to double the production of average vessel.

South of Dakar, the fishing is also seasonal; the highest production is between December and July. This region has been more productive than northern one. Catches up to 1 ton have been made in 6 hours of dragging. Daily average catch rates have ranged from 450 to 1,600 pounds.

Dakar, the capital, has a population of 375,000. Its large port has over 6,500 feet of dock space for trawlers, and almost 1,300 feet for tuna vessels. Ice-producing capacity is 180 tons per day; plans are being made to double this. Diesel fuel for fishing vessels is not taxed and costs 16 cents per gallon. Fishing vessel regulations, enforced by Department of Fisheries, prohibit wooden vessels older than 15 years, and steel vessels older than 20. Annual fishing permits cost $40 per gross ton. Also, Senegalese-registered vessels pay a tax of $0.01 per ton of landed catch, and non-Senegalese vessels pay 13% of catch value.

The life cycle of the shrimp of Senegal are being studied jointly by a biologist of the Department of Fisheries and two biologists of the French research organization, Office de la Recherche Scientifique et Outre-Mer (ORSTOM).

SIERRA LEONE

Commercial fishing is relatively undeveloped. The only activities are the local canoe fishery, which includes shrimp, a tuna-transhipment facility, and 9 local small bottom trawlers. In the port of Freetown, the capital with a population of 128,000, dock space for fishing vessels is limited to 130 feet at the tuna facility. The 9 trawlers unload into canoes while at anchor.

The country has 3 large estuarine areas that should produce shrimp in commercial quantities. Its coastline is approximately 200 miles; its Continental Shelf varies from 22 to 75 miles wide.

The official language is English.

LIBERIA

Commercial fishing is conducted by two private companies that charter foreign-flag vessels. These catch shrimp incidental to fish--but do not attempt to catch shrimp exclusively. As a result of 2 months of exploratory shrimp fishing, one company is building 4 shrimp vessels for use this year.

A canoe shrimp fishery supplies fresh shrimp to local market. Best production is in spring, although catch statistics are not maintained.

Liberia's coastline is about 285 miles; its Continental Shelf 15 to 35 miles wide. Monrovia, with a population of 81,000, is the capital and major port. There is limited dock space for fishing vessels, but adequate waterfront space for more docks. Fishing-vessel licenses are $150 per vessel; diesel fuel is 15 cents per gallon.

English is the official language.

IVORY COAST

Three large estuaries provide excellent nursery areas for shrimp in Ivory Coast. The canoe fleet catches juvenile shrimp almost all year; in 1968, it caught nearly 400 tons.

Offshore commercial fishing for shrimp is very limited. At present, two trawlers drag for shrimp during July to October, the season of highest production. Their production, plus the incidental shrimp catch from fish trawlers, was: 1964--160 tons; 1965--145 tons; 1966--155 tons; 1967--171 tons.

Ivory Coast has 280 miles of coastline; its Continental Shelf is 10 to 16 miles wide. Abidjan, the capital of this French-speaking country, has 180,000 persons. At the turn of the century, it was a fisherman's camp; now it is an important industrial and commercial fishing port. The fishing vessel dock is being extended. A cold-storage plant will be built in the fishing port complex. It will have a blast freezing capacity of 90 tons per day, and a holding capacity of 3,000 tons.

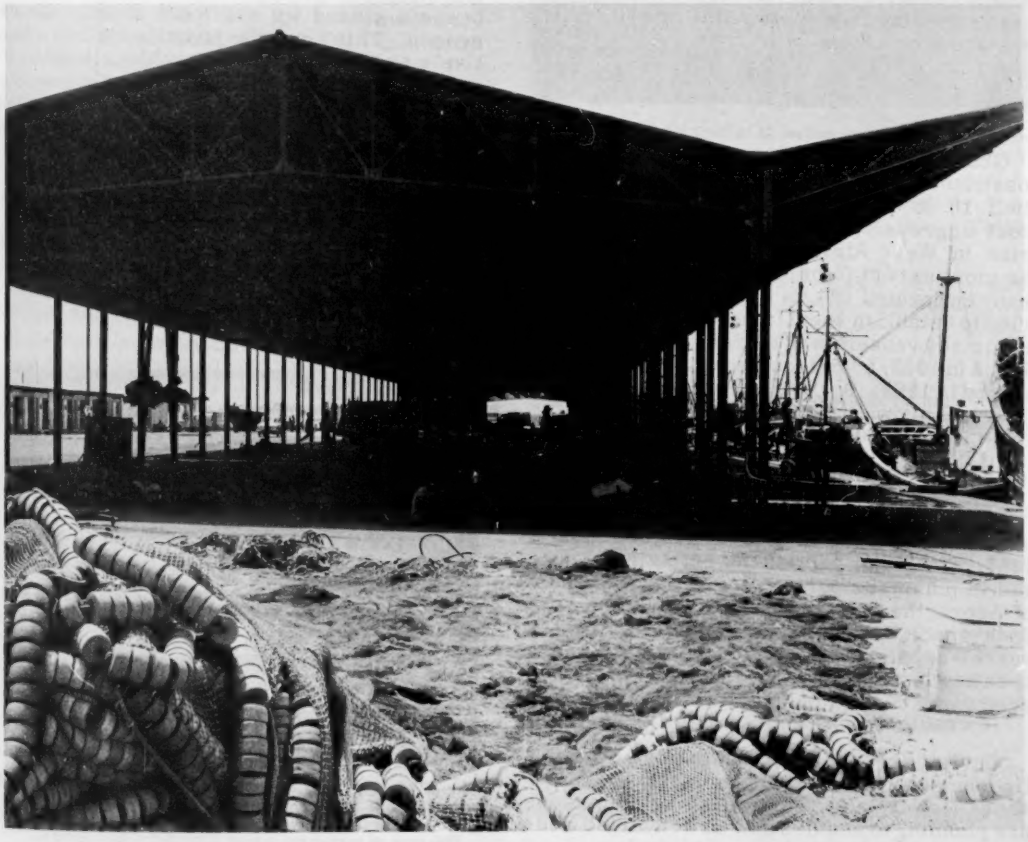

Fig. 3 - The open-air auction shed at the fishing port in Abidjan, Ivory Coast. Minimum prices are fixed by law for fish landed by local fleet.

The government recently granted permission for three French/Ivoirian fishing companies combined to introduce not more than 10 shrimp vessels during the next 3 years. The companies have agreed to pool their resources and build a modern shrimp-processing plant.

The Ivoirian Fisheries Service is cooperating with a private French/Japanese venture in shrimp mariculture. Two large cement tanks, built several years ago on the coast east of Abidjan by the Fisheries Service; are being loaned for the shrimp-farming experiment.

Two biologists on the ORSTOM staff at Abidjan are studying distribution of offshore shrimp stocks. They use the laboratory's 82-foot research vessel 'Reine Pokou' to make sampling drags between 10 and 100 fathoms about once a month.

GHANA

Ghana, an English-speaking country, has a coastline of about 280 miles, and a Continental Shelf 15 to 40 miles wide. It is one of the most aggressive commercial fishing countries in West Africa; Ghanaians are among the most expert fishermen. Over the years, many emigrated to other West African countries to establish local fisheries. Thirty-foot motorized vessels were first introduced into Ghana in 1952; a 75-foot-and-above class appeared in 1962. By 1967, the offshore fishing fleet had grown to 439 vessels, and the estuarine fleet to 10,000 canoes.

With the introduction of larger vessels, fish production increased dramatically: from nearly 30,000 tons in 1961 to 115,000 tons in 1967. The major part of the catch is processed in manmade port of Tema, 20 miles east of Accra, the capital. Tema has 3,400 feet of dock space, a small boatyard, and limited vessel-repair facilities. The Tema-Accra area has 13,000 tons of cold storage space and produces 100 tons of ice per day.

Shrimp are taken in the estuaries by canoe fishermen and are caught incidentally in offshore fish trawling. Two fishing companies are planning to acquire new or converted vessels for catching shrimp exclusively.

The Ghanaian Fisheries Service conducts biological research and fishermen training programs. Most research is devoted to finfish because of their importance to the economy. Shrimp catch statistics are not collected. A biologist on the staff of a UN Special Fund Program at Tema has been sampling periodically offshore shrimp stocks. He plans to expand this work after he receives some needed vessel equipment.

TOGO

Togo's 40-mile coastline and its narrow Continental Shelf (15-20 miles wide) place a natural limitation on development of an offshore shrimp fishery. However, Togo has an estuarine canoe fishery for shrimp. The Department of Fisheries told me that the channels connecting the estuaries to the sea become closed by sediment during the dry season. This traps the juvenile shrimp effectively and creates a favorable situation for the canoe fishermen. With the rainy season, the increased flow of water reopens the channels and permits the normal shrimp life cycle to continue.

Lomé, the capital of this French-speaking country, has a population of 80,000. It has a manmade harbor for general cargo, but it does not have a fishing port. The West German government helped draw up plans to construct a fishing port about a mile east of the existing port.

Fig. 4 - Boiled, whole shrimp and live crabs at a fish market in Lomé, Togo. The shrimp are juvenile pink shrimp, Penaeus duorarum notialis, caught by canoe fishermen in local estuaries. This type of marketing is seen throughout West Africa.

The Togo Department of Fisheries, established in 1963, now has a program to determine the cyclical abundance of estuarine shrimp. A West German Fisheries Assistance Program operates two research vessels in fish trawling explorations. Recently, they made good catches of shrimp, incidental to fish trawling in 20 to 25 fathoms. They are constructing a shrimp trawl for a concerted effort to determine shrimp abundance.

NIGERIA

The commercial fishing industry is well established. Demand for fishery products is high. The availability of shrimp in offshore waters was determined several years ago when 28 vessels dragged for shrimp. During the recent civil war, most productive shrimp grounds off Niger River Delta were closed, and nearly half the vessels moved to other shrimp grounds. Fifteen shrimp vessels were restricted to working only the extreme western coastal area. This has resulted in a drop in landings, although comparative production figures are not known. The following shrimp landings by the 15 vessels for 1968 were collected by the Federal Fisheries Service. These indicate the seasonal production trend:

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Tons (short)	47	56	64	58	114	56	62	35	27	33	25	27	604

Nigeria has about 500 miles of coastline, and its Continental Shelf is 15 to 35 miles wide. Lagos, capital of this English-speaking country, has 675,000 persons. It is the largest port facility. Private fishing companies own about 2,000 feet of dock space. Cold storage space, fuel, water, ice, and repair facilities are available. State-owned dock facilities are not available, although plans have been prepared to construct a modern, centrally located fisheries terminal. Four additional ports are available: Pt. Harcourt, Calabar, Sapele, and Warri.

The Federal Fisheries Service has about 200 employes working on marine and freshwater (Lake Chad) projects. Three biologists in Lagos have been working exclusively on marine shrimp research. The Fisheries Service has a 70-foot, steel-hulled vessel for biological and oceanographic research. Shore facilities in Lagos include laboratories, behavior study tanks, a reference collection of local marine fauna, and a library well stocked with current research publications.

Fig. 5 - Part of the fleet of 42 sardine seine vessels in Abidjan, Ivory Coast. Vessels are licensed and the number strictly controlled by Fisheries Division.

CAMEROON

Cameroon, a French-speaking country, received its name from Portuguese explorers who found cameroes (shrimp) schooling abundantly off the coast. Until recently, however, shrimp have not been important in local commercial fisheries. The country has a coastline of 185 miles with a Continental Shelf 15 to 35 miles wide. Douala, the major port, has a population of 190,000.

Five fishing companies operate in Douala; of these, two now process shrimp and are preparing to catch and process shrimp on a larger scale. Several foreign-flag vessels are catching shrimp for one of the companies.

In a trip completed during my visit, one of these vessels, dragging two 37-foot beam trawls, averaged 800 to 1,000 pounds of

shrimp per day. This catch, when graded, comprised two sizes: 15/20 and 40/50 per pound (heads off).

The second company used a 75-foot vessel on a shrimp exploratory survey within the 50-fathom contour. As a result, the company has ordered eight 72-foot shrimp vessels. It also is building a shrimp processing and freezing plant complete with machine and welding shops, radio room, parts storage, and offices.

About 540 feet of dock space are available for fishing vessels in Douala. Unused waterfront space is conveniently located for dock expansion, although dredging would be required.

There is no marine fishery research in Cameroon. Personnel from ORSTOM, Pt. Noire, Congo Brazzaville, have made dragging transects in Cameroonian waters.

CONCLUSIONS

The estuarine fishery for juvenile shrimp in West Africa indicates that shrimp breed there in substantial quantities. Life cycle studies of P. duorarum duorarum in the United States revealed that, when the shrimp reached adult stage, they migrated from estuaries to coastal waters, where they completed their life span. Generally, they stayed within the 50-fathom contour.

Evidence from limited studies in West Africa suggests P. duorarum notialis has a similar life cycle. Evidence shows possibility of expanding shrimp fishery to at least double present level, but it is inadequate to determine full development. This limits amount shrimp-fishing companies are willing to invest in relatively sophisticated shrimp catching and processing equipment required to promote export-oriented operations. Some expansion of shrimp fishery can be foreseen, but further developments would be facilitated greatly if more reliable information, based on a comprehensive scientific survey, were available.

It is apparent, too, from biological sampling of research programs in West Africa, and from fishing by Spanish shrimp fleet, that deepwater shrimp also are available. Again, information is lacking on their distribution and availability. Operational costs of offshore fishing generally are greater than those of inshore fishing. Also, operational techniques and gear requirements differ for inshore and offshore fishing. This type of information should be provided to fishing companies interested in the fishery.

To provide this information, exploratory fishing operations will be necessary. Objectives would be to define seasonal availability and distribution of shrimp resources and their potential for commercial use, and to provide estimates of abundance of major species and of their potential annual yield.

Shore facilities, which would be adequate for a thriving shrimp industry, vary considerably from country to country. Docks, shrimp processing plants, ice plants, vessel maintenance shops, and dry docks ultimately will have to be expanded or built in all potential major shrimp-processing centers. Fishing centers such as Dakar, Senegal, and Lagos, Nigeria, are equipped for shrimp processing--but all other major ports will require one or more of the facilities listed above.

Shrimp vessels will have to be built or brought from other areas to make up the required fleet. Most of existing fishing fleet was not designed for shrimping; many are small purse seiners underpowered for dragging operations. The requirements for deepwater shrimp vessels would be rigorous; this type of vessel also would have to be introduced.

Undoubtedly, the potential for development of the shrimp industry in West Africa is tremendous. Its growth will have a significant economic impact on the entire area before the next decade ends. All recent technological advances in the shrimp industry--including harvesting, processing, and merchandising--should be used to fully utilize these latent resources.

BIBLIOGRAPHY

CROSNIER, A.; E. DeBONDY; and S. LEFEVRE
1967. Commercial shrimps of the tropical West African coast. Office de la Recherche Scientifique Outre-Mer, Paris, Initiations-Documentations Technique, (7): 60.

___and J. J. TAUTER
1968. Notes on the Spanish shrimp fishery along the coast of Congo and Angola. Office de la Recherche Scientifique et Technique Outre-Mer, Centre de Pointe-Noire, Oceanographic Document No. 422 S.R., 7 p.

DiPALMA, SALVATORE
1968. The fisheries of Cameroon, 1967. U.S. Fish and Wildlife Service, Foreign Fisheries Leaflet No. 169, Washington, D.C., 5 p. (mimeographed).

FARFANTE, ISABEL PEREZ
1969. Western Atlantic shrimp of the genus Penaeus. U.S. Fish and Wildlife Service, Fishery Bulletin, Vol. 67, No. 3, x + p. 461-591.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
1968. Catches and landings, 1967. FAO Yearbook of Fishery Statistics. Vol 24, 408 p.

FEDERAL FISHERIES SERVICE
1967. Annual report, Nigeria. 38 p.

KRISTJONSSON, HILMAR
1968. Techniques of finding and catching shrimp in commercial fishing. FAO (Food and Agriculture Organization of the United Nations) Fisheries Reports, No. 57, Vol 2, pp. 125-192.

MONOD, T.
1966. Crevettes et crabes de la Cote occidentale d'Afrique, Memoires de l'Institut Fondamental d'Afrique Noire, (77): 107-234. Institut Fondamental d'Afrique Noire, Dakar, Senegal.

[U.S.] NATIONAL OCEANOGRAPHIC DATA CENTER
1968. Report on the Guinean trawling survey. Volume III Data report. Organisation of African Unity Scientific, Technical and Research Commission, Lagos, Nigeria, Publication 99, vi + 551 p.

WILLIAMS, F.
1968. Report on the Guinean trawling survey. Volume I General report. Organisation of African Unity Scientific, Technical and Research Commission, Lagos, Nigeria, Publication 99, viii + 828 p.

1968. Report on the Guinean trawling survey. Volume II Environment charts. Organisation of African Unity, Scientific, Technical and Research Commission, Lagos, Nigeria, Publication 99, 529 p.

THE ATLANTIC SURF CLAM FISHERY (1968)

Robert M. Yancey

The 1968 surf clam fishery provided 40.4 million pounds of meats--4.4 million pounds less than in 1967. A 9.1-million-pound decrease in New Jersey landings was offset partially by increased landings in New York and Maryland--3 and 5.2 million pounds. The southward shift in effort, which began in 1967, continued this year. The number of vessels decreased at Point Pleasant, N. J., but increased at Cape May-Wildwood, N. J., and at Ocean City, Md.

FISHING AREAS

There are four main surf clam fishing areas in the middle Atlantic bight: Long Island, N. Y., Point Pleasant, N. J., Cape May, N. J., and Ocean City, Md. As in the past few years, the New Jersey fishery contributed most to 1968 landings, although the 32.1 million pounds landed were a smaller share (80%) than in previous years (table). The importance of the Cape May-Wildwood area increased in 1968: landings exceeded Point Pleasant's for the first time in our observations.

Surf Clam Landings by Area (1968)

Area	Number of Vessels		Landings (Millions of lbs.)	
	1967	1968	1967	1968
Long Island, N.Y.	5	7	2.3	3.0
Point Pleasant, N.J.	34	30	22.9	14.0
Cape May-Wildwood, N.J.	26	42	18.4	18.2
Ocean City, Md.	2	7	1.2	5.2
Total	67	86	44.8	40.4

The areas fished by the New Jersey fleets in 1968 (fig. 1) were similar to 1967, but the irregular patterns of 1967 (Yancey, 1968) were filled by exploratory trips seeking dense beds of larger clams. Surf clams landed in New York were taken from the same areas off the southern coast of Long Island as reported for 1967. At Ocean City, Md., most vessels continued to fish inshore and north of the Ocean City inlet. In this area, little use was made of known offshore clam stocks.

FLEETS AND METHODS

The Point Pleasant fleet was reduced to 30 vessels, including one new boat; this was four fewer than in 1967 (table). Depths fished ranged from 12 to 37 meters (40 to 120 feet); average depth fished was 22 meters (73.2 feet). As usual, most vessels made 1-day trips during daylight hours, although a few overnight trips were completed when conditions were particularly favorable. An average of 2.5 days was fished each week, and up to 21 hours were fished each day. Monthly averages of hours fished per boat-day are shown in Figure 2. The average for the year was 9.8 hours, or 1 hour less than in 1967. Dredge hauls continued at an average rate of four per hour, as in the past.

The expanded fleet at Cape May-Wildwood consisted of 42 boats, or 16 boats more than the previous year (table). Four of these were new boats, while the balance of the increase came from Point Pleasant. The depths of clam beds fished off Cape May were 8 to 35 meters (25 to 116 feet), with an average depth of 15 meters (47.4 feet). Most boats made 1-day trips and fished up to 21 hours. Monthly averages are shown in Figure 2. The average for the year was 7.9 hours of fishing time per trip. Three dredge tows per hour were made in 1968, as in 1967.

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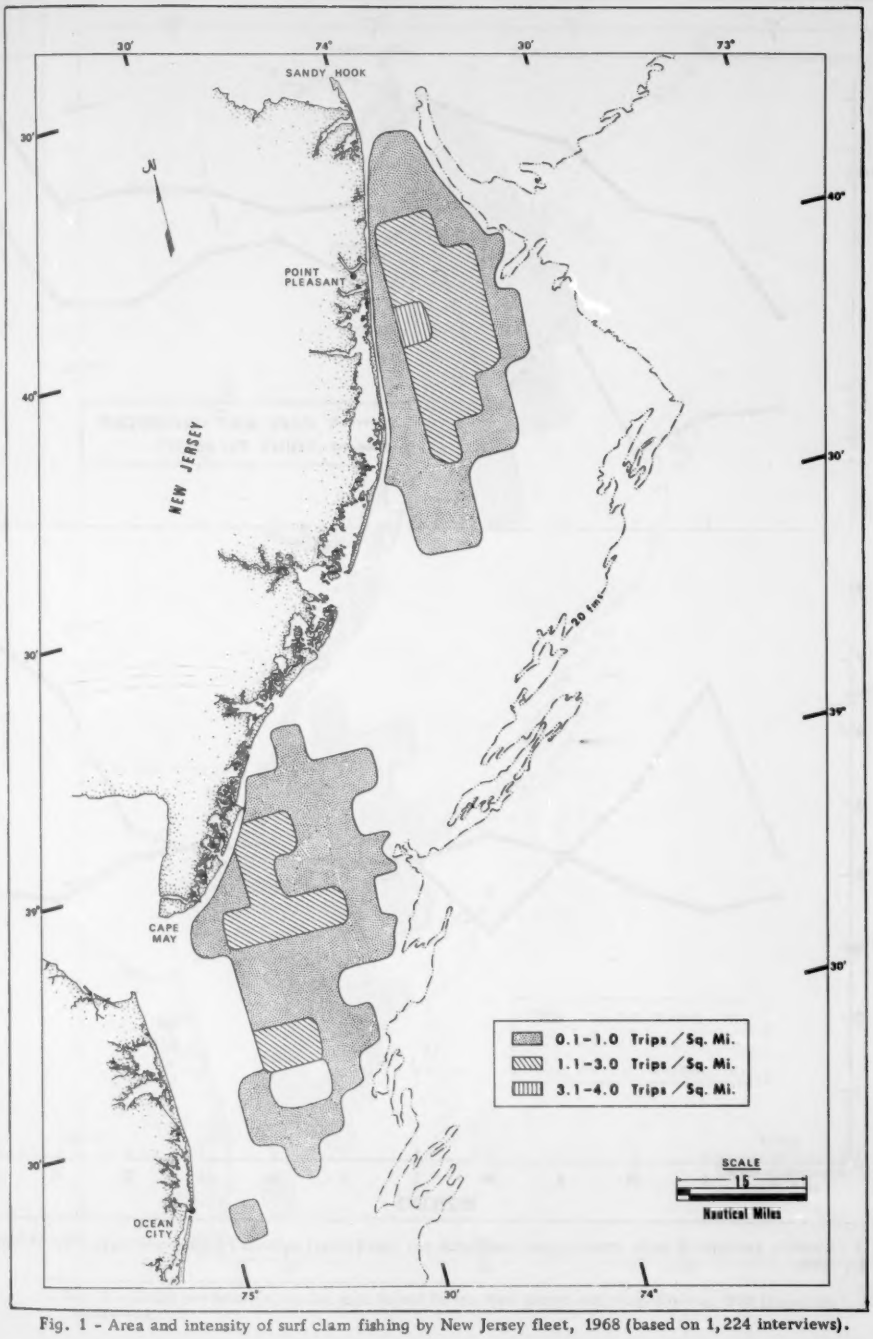


Fig. 1 - Area and intensity of surf clam fishing by New Jersey fleet, 1968 (based on 1,224 interviews).

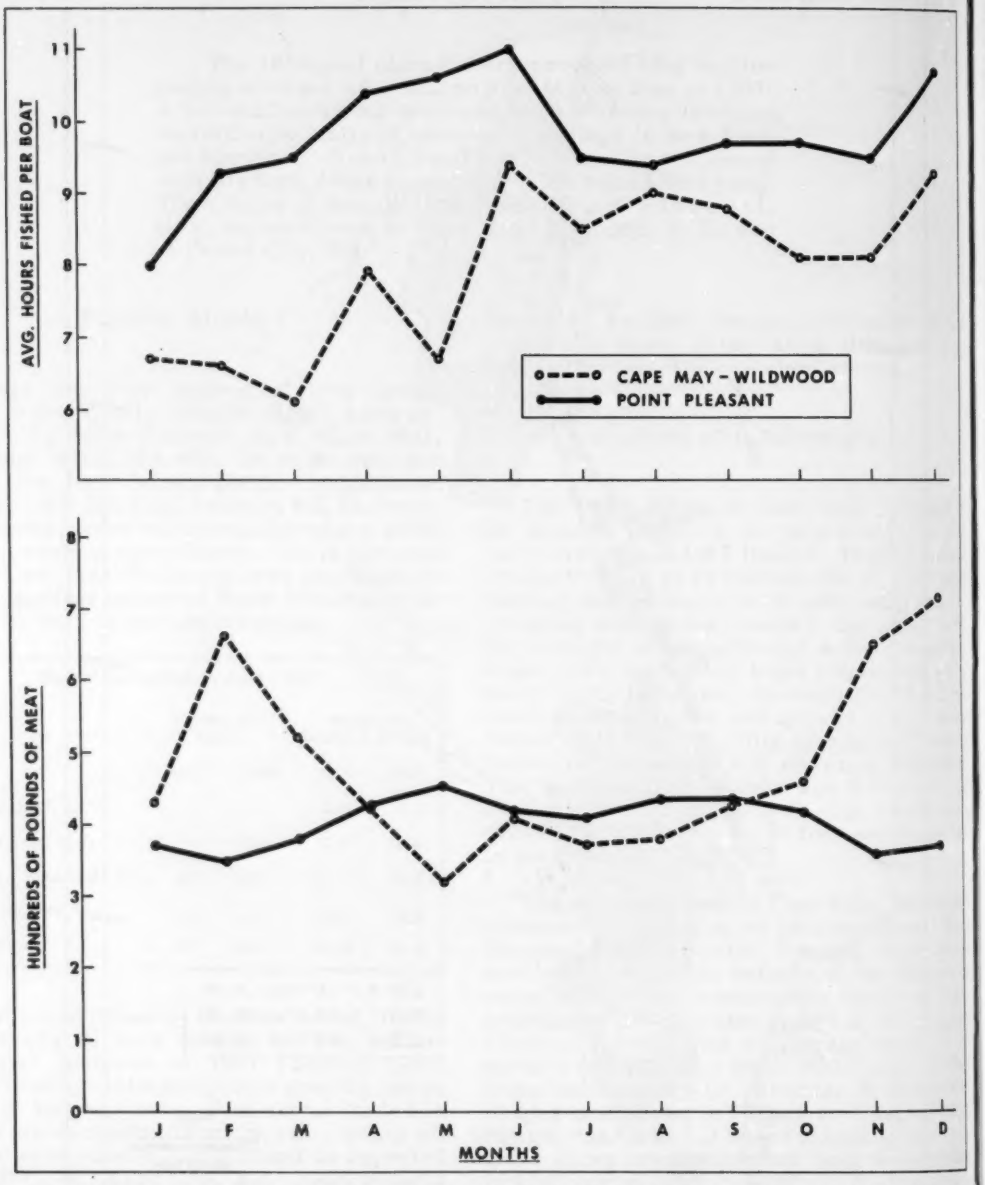


Fig. 2 - Monthly averages of daily effort (upper) and catch per hour (lower) at Point Pleasant and Cape May-Wildwood, N. J., 1968.

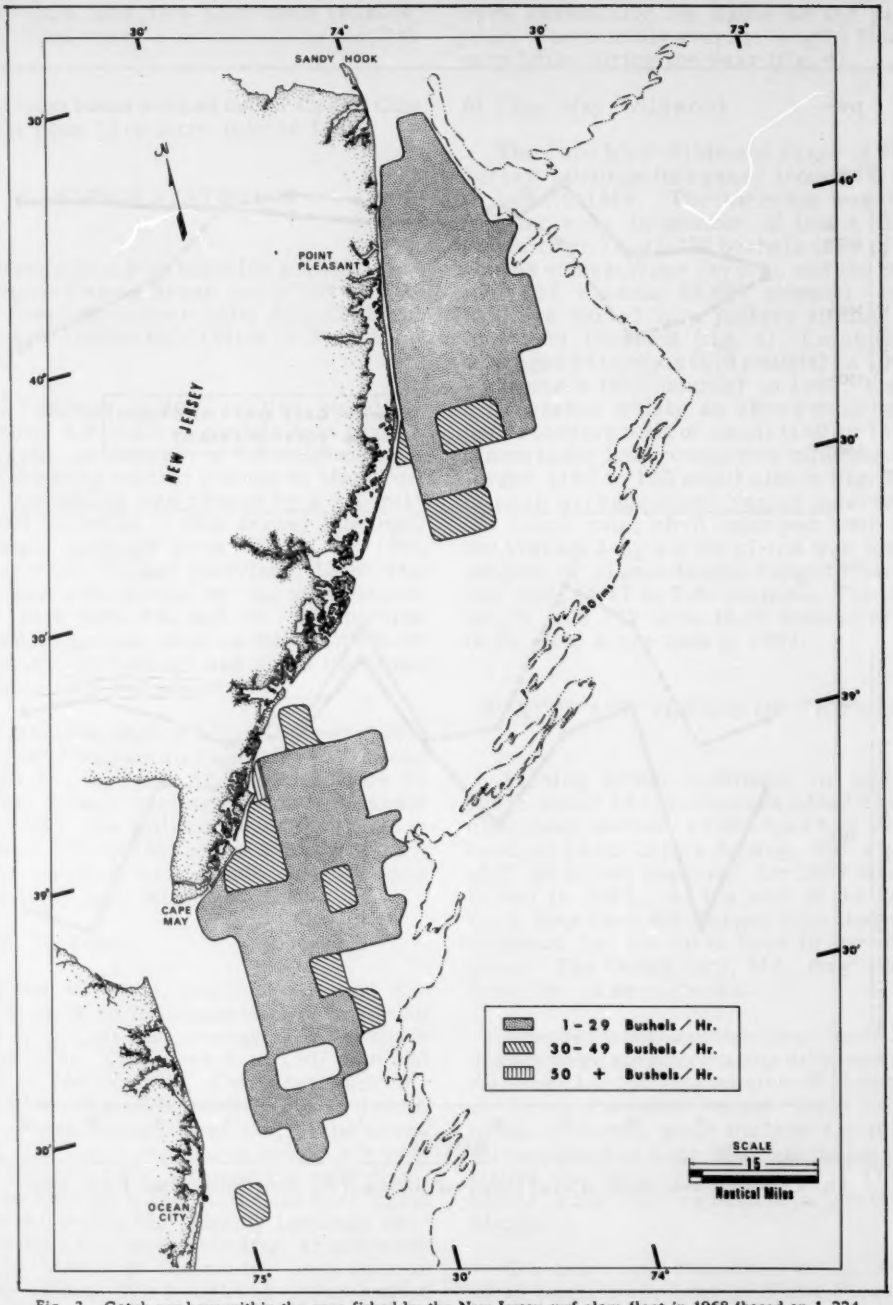


Fig. 3 - Catch per hour within the area fished by the New Jersey surf clam fleet in 1968 (based on 1,224 interviews).

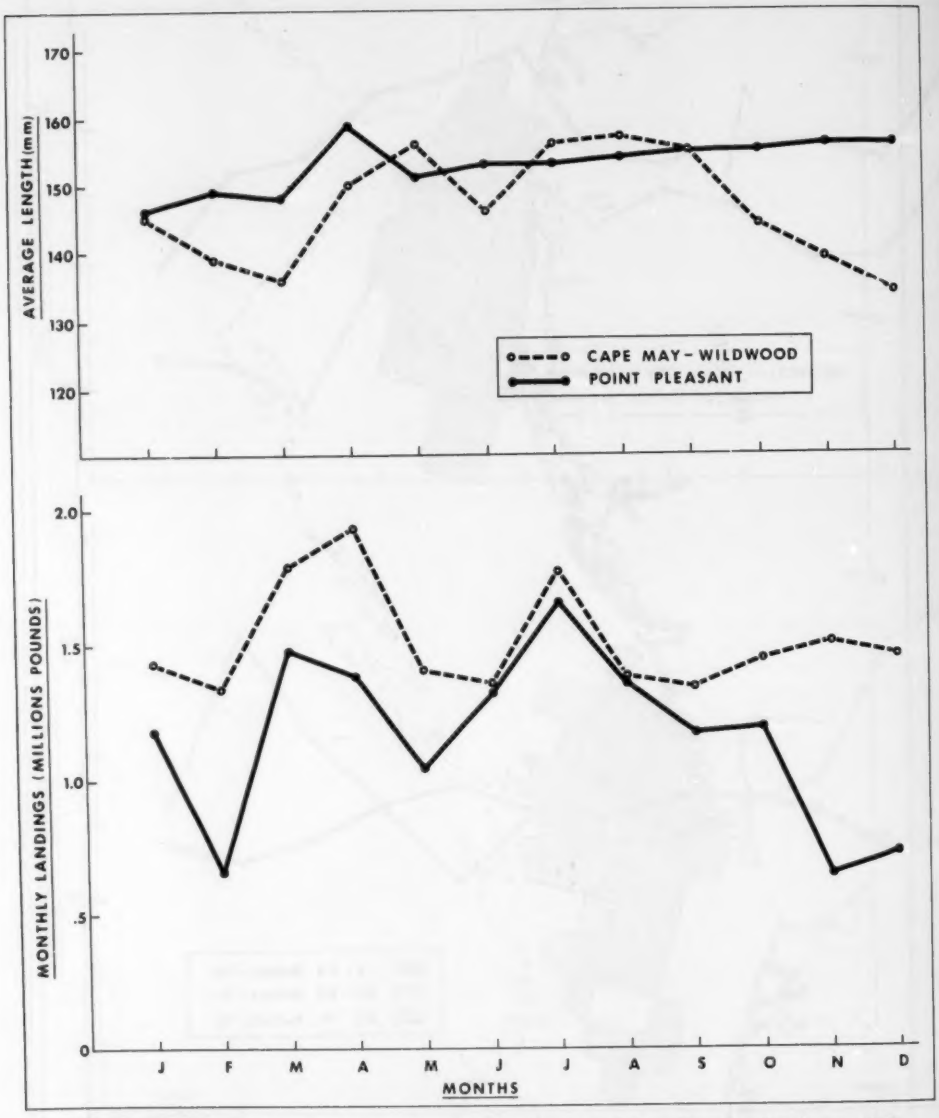


Fig. 4 - Monthly mean lengths of clams (upper) and landings of surf clams (lower) in New Jersey, 1968.

The New York fleet consisted of five (one new) full-time and two part-time vessels. The part-time vessels landed clams for fish bait.

Seven clam boats worked out of Ocean City during the year (five more than in 1967).

LANDINGS STATISTICS

Interviews by a port sampler provided information on fishing areas and effort in New Jersey. Landings in the middle Atlantic bight were provided by the BCF Office of Statistical Services.

Total landings of 40.4 million pounds of meats were 4.4 million pounds less than in 1967, despite an increase of 0.7 million pound in New York and 4 million pounds in Maryland (table). The deficit was caused by a 9.1 million pound decrease in New Jersey landings. New Jersey landings were 80% of the 1968 total; New York, 7%; and Maryland, 13%. The percentages contributed by the same States in 1967 were 92%, 5%, and 3%. The portion of the total landings used as fish bait (sport and commercial fishing) was about the same at last year (700,000 pounds).

The continuing shift in effort (Yancey, 1968) from Point Pleasant to Cape May-Wildwood was reflected again in the contributions to total New Jersey landings. Point Pleasant provided 43% (14 million pounds) in 1968--down from 55% in 1967. The Point Pleasant fleet, for the first time, landed fewer clams than the Cape May-Wildwood fleet.

At Point Pleasant

At Point Pleasant, landings per boat-day ranged from 10 to 768 bushels (170 to 13,056 pounds of meats) and averaged 233 bushels (3,961 pounds). The average in 1967 was 220 bushels (3,740 pounds). Catch per hour averaged 24 bushels (408 pounds) in both years. Figure 3 shows the catch per hour in the areas fished. The catch rate remained fairly uniform throughout 1968, although the rate dropped below average in the winter and rose again in the summer (fig. 2). Monthly landings varied more than the catch rate (fig. 4) and were generally lowest in the winter when storms limit the effort. The lengths of clams landed varied from 109 to 184 mm. (4.25 to 7.25 inches). The average length was 153 mm. (6 inches). This range and average length were essentially the same as the previous year. The monthly average lengths fluctuated very little during the year (fig. 4).

At Cape May-Wildwood

The Cape May-Wildwood share of the New Jersey landings increased from 44% in 1967 to 56% in 1968. The increase was due to a 60% increase in number of boats. Vessels landed from 15 to 1,177 bushels (255 to 20,009 pounds of meats) per day trip, and the average was 225 bushels (3,825 pounds). Monthly landings varied in a pattern similar to that for Point Pleasant (fig. 4). Catch per hour averaged 34 bushels (578 pounds) in 1967, and 28 bushels (476 pounds) in 1968. Catch per hour varied widely as effort switched from dense inshore beds of small (130 to 140 mm.) clams to the less productive offshore beds of larger (150 to 155 mm.) clams (fig. 2). The monthly average length varied inversely with the catch rate; when catch per hour was up, the average length of the clams was less. The lengths of clams landed ranged from 111 to 195 mm. (4.37 to 7.68 inches). The average length was 147 mm. (5.75 inches) or 6 mm. (0.25 inch) more than in 1967.

STATUS AND TRENDS OF THE FISHERY

Fishing effort continued to increase in 1968: about 18 vessels were added to the surf clam fleet, and hours fished per trip increased by about 1 hour in New Jersey. The southward shift in effort reported for 1967 was maintained in 1968. At the end of the year, the Cape May fleet was larger than that at Point Pleasant for the first time in our observations. The Ocean City, Md., fleet increased from two to seven boats.

Average lengths of the clams landed in New Jersey were not appreciably different in 1967. As usual, the average lengths of clams landed at Point Pleasant varied very little from month to month, while the average lengths of clams landed at Cape May varied as the fleet fished the inshore beds of small (120 mm.) clams or the offshore beds of larger (150 mm.) clams.

The catch rate stabilized at the 1967 level of 24 bushels per hour at Point Pleasant, but it decreased from 34 bushels to 28 bushels at Cape May. The catch rate at Cape May,

like the average length, varied with the source of the clams.

The Ocean City, Md., fishery shows promise of further expansion and will probably contribute an ever-increasing portion to total landings.

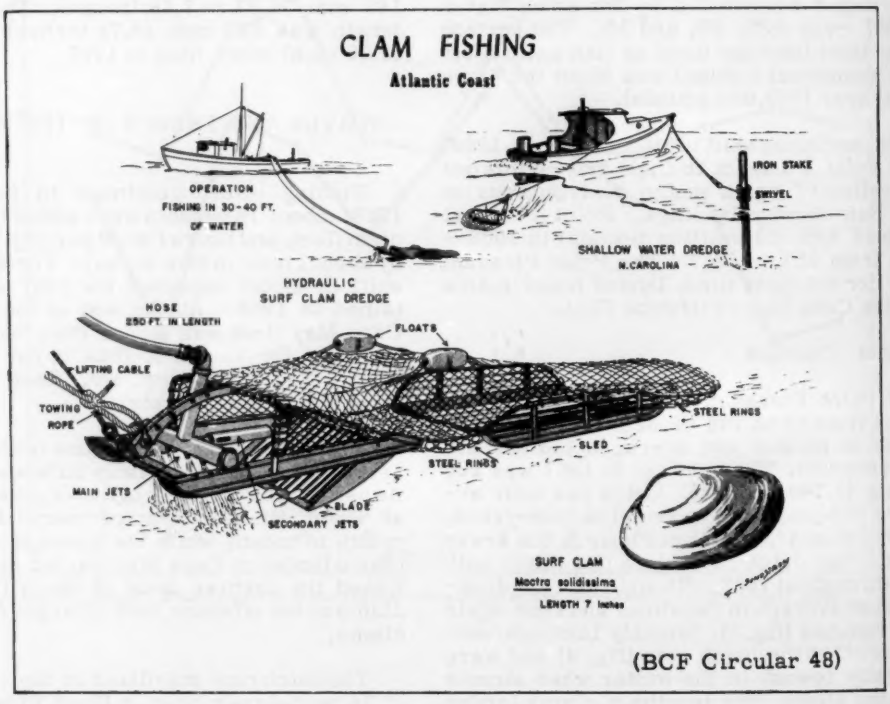
The New York fishery will probably continue its slow increase, but its expansion is limited by the extent of the beds off Long Island.

LITERATURE CITED

GROUTAGE, T. M. and A. M. BARKER
1967a. The surf clam fishery. Comm. Fish. Rev. 29(2): 55-58. Also Sep. No. 780.

1967b. The Atlantic surf clam fishery in 1966. Comm. Fish. Rev. 29(8-9): 64-67. Also Sep. No. 797.

YANCEY, R. M.
1968. The 1967 Atlantic coast surf clam fishery. Comm. Fish. Rev. 30(11): Also Sep. No. 829.



BCF SCIENTISTS TAG AND RECOVER MENHADEN

Paul J. Pristas

In 1965, BCF biologists at Beaufort, N.C., began an extensive tagging program on the Atlantic menhaden, Brevoortia tyrannus. Later, they expanded the program from New York to Florida. In 1969, they tagged Gulf menhaden, B. patronus, from Cameron, La., to Moss Point, Miss. These studies are timely because of the record low catch in the Atlantic and the record high catch in the Gulf in 1969.

The results of this tagging provide direct evidence of growth, mortality rates, interchange of fish between fishing areas, and the importance of certain estuaries in the production of menhaden. This information is needed to determine the causes of fluctuations in menhaden abundance--to assess effect of fishing on the populations, to develop estimates of optimum harvest, and to support recommendations for managing the fishery.

Tagging & Recovery Equipment & Methods

The program's initial phase was to test equipment and methods for tagging menhaden and recovering the tags. A tagging gun developed by a Norwegian firm, Bergen-Nautik, for tagging herring proved satisfactory for menhaden; it has been used in our studies. The gun inserts a stainless-steel tag ($\frac{9}{16}$" by $\frac{1}{8}$" by $\frac{1}{32}$") into the body cavity of the fish. The tags are recovered on magnets in menhaden reduction plants. An electronic tag detector has been used with some success in recovering marked fish as they are conveyed from boat to plant (photographs).

In 1966, nearly 97,000 menhaden were tagged and released in the Beaufort, N.C., area while we developed the best methods possible for procuring, holding, handling, and releasing the fish. Analysis of later recoveries showed that the best way of taking fish from commercial catches was either by brail or dip net; they did not have to be anesthetized for handling; and individuals released immediately after tagging survived better than fish retained and released in a group. These procedures were used in a tagging program of the Atlantic menhaden fishery.

Expanded Tagging Program

In 1967, the program was expanded. Crews tagged menhaden in Florida, North Carolina, Chesapeake Bay, and New Jersey. We tagged 324,141 fish during the spring and summer, and 38,920 fish in the North Carolina fall fishery. Tag recoveries were increased by the installation of magnets in all menhaden plants on the Atlantic coast. In spring and summer 1968, BCF crews tagged 378,533 menhaden from New York to Florida; during fall fishery, 6,937 more. We also tagged 524 in December in Florida. This made 1968 our most productive tagging year: a total of 385,994 fish. In 1969, crews tagged 217,584 menhaden during spring and summer, and 3,091 during fall.

In 1969, BCF began the Gulf menhaden phase of its mark-recovery experiments; it continued tagging Atlantic menhaden. BCF magnets were installed at 4 plants in the Gulf area; 27,095 menhaden were tagged in spring. Recoveries of these tags during summer were encouraging. An additional 8,103 marked fish were released near end of fishing season.

The tagging of juvenile menhaden in tributaries also began in 1969. These fish were marked with tags about one fourth as large as those used for tagging commercial-size menhaden.

RESULTS

As of December 1969, more than 1,066,000 menhaden had been tagged and released in the Atlantic from New York to Florida. We estimate that nearly 203,000 tagged fish, or 19% of those released, have been recaptured (table). This percentage will increase when adjusted for tag losses due to shedding and mortality.

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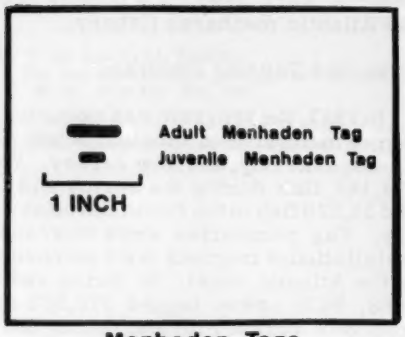
B. C. F. Menhaden Tagging and Recovery



Menhaden Tags

A Menhaden Being Tagged

Tagging Aboard B.C.F. Vessel

Tagging Aboard Commercial Fishing Vessel

Recovery of Tags From Magnets in Menhaden Plant

Electronic Detector System for Recovery of Tagged Fish

Menhaden Tagging: Yearly Releases and Estimated Recoveries

Year	Location	Releases	Recoveries	
		Number	Number	Percent
1966	Atlantic	96,627	11,262	11.7
1967	Atlantic	363,061	91,083	25.1
1968	Atlantic	385,994	84,106	21.8
1969	Atlantic	220,675	16,586	7.5
	Gulf	35,198	6,860	19.5
Total:	Atlantic	1,066,357	203,037	19.0
	Gulf	35,198	6,860	19.5

Tag recoveries indicate that Atlantic menhaden move northward along the coast in spring and summer, and southward along the coast in fall and winter. As the fish get older and larger, they migrate farther north.

Tags continue to be recovered from fish released in 1966. This proves that fish can survive for an extended period with an internal tag. Actual recoveries from some groups of marked fish have been higher than 60%.

Through October 1969, more than 35,000 menhaden have been tagged and released along the Gulf coast from Cameron, La., to Moss Point, Miss. We estimate that nearly 6,900 tagged fish, or 19% of those released, have been recaptured (table). This percentage also will increase when we make adjustments for tag shedding and tagging mortality.

These data did not show much movement of tagged fish in the Gulf during their first summer after tagging. Some westward movement of fish released at Empire, La., was apparent; some Cameron releases may have moved east as far as Empire, but not as far as Moss Point. Recoveries in 1970 will provide our first information on movements of Gulf menhaden in the period between fishing seasons.

To estimate rates of mortality and growth from tag returns, recoveries are needed from several years of fishing. The determination of the amount of movement between fishing areas also requires several years of recoveries.

Information obtained from these studies of Atlantic and Gulf menhaden will help us to utilize wisely the menhaden resources.

QUICK RELEASE BRANCHLINE CLIP DEVELOPED FOR LONGLINING

Michael G. Corbett

The longline auto-clip, an improved clip, has been developed for the automatic or manual attachment and detachment of longline branchlines and buoylines. Its use will improve safety, speed, and efficiency through better use of manpower.

A satisfactory clip must be easy to attach and detach, permit mainline to rotate freely, must not slide along mainline, and still be readily adaptable to mechanical attachment and detachment. Clips that fulfill some of these requirements have been developed.

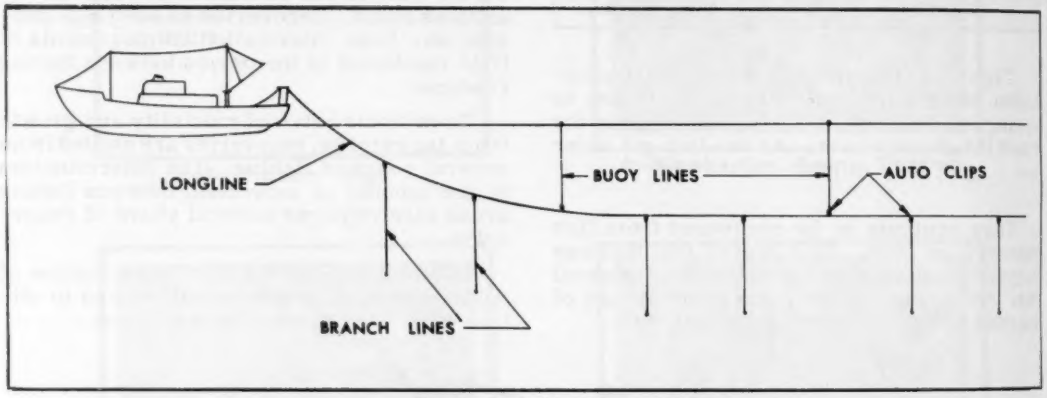


Fig. 1 - Typical longline operation.

Longlining is a method used extensively in commercial fishing for tuna, swordfish, and halibut (Fig. 1). It may be used for any fish that will strike a baited hook. A fishing boat pays out a main or longline, to which are attached branchlines and buoylines at spaced intervals. Each branchline has one or more baited hooks; each buoyline has a float. In tuna fishing, the longline may be 10 to 12 miles long and carry 1,000 branchlines and buoylines.

Early systems for handling longline gear used knots for attaching branchlines and buoylines to the longline. Fishing-gear technologists have emphasized frequently the advantages of a readily detachable clip to secure these lines to the longline. Such a system enables baiting of hooks prior to shooting (paying out) the longline, speeds both shooting and hauling (line retrieval) processes, and decreases labor requirement.

Generally, these clips are heavy wire bent in shape to allow them to be snapped onto longline. In use, however, these clips often slip along longline or, occasionally, deform under tension of pull from a large fish and sometimes unsnap from longline when they strike the boat during haulback. Known designs of such clips cannot readily be adapted to a mechanical attaching and detaching operation.

The BCF Exploratory Fishing and Gear Research Base, Gloucester, Mass., developed the longline auto-clip. It has these features: 1) mechanical attachment and detachment from moving mainline, 2) capacity for simple alternate manual operation when necessary, 3) nonslippage of branchline along mainline, 4) a design suitable for further development of a fully automated longline fishing operation, 5) strength equal to or greater than other longline components, 6) positive holding of branchline(s) with fish to mainline, and 7) simple fabrication by conventional techniques.

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DESCRIPTION

Figure 2 shows configuration of longline auto-clip. The clip includes an upper and a lower body plate (A). These body plates are identical and are formed by die stamping from corrosion resistant 6061 T6 aluminum alloy strapping. Three spring guide projections (1) and a jaw stop projection (2) extend inwardly on each body plate. These projections are formed during the die stamping operation. On the midline at the front end of each body plate is a slot or throat (3) that tapers and terminates in a radius of curvature equal to or very slightly smaller than the radius of the longline. On either side of the throat are ears (4); each ear has a hole. A third hole is located on the midline near the back end of each body plate. The two body plates are held apart by bushings (B) mounted on rivets (C). The bushings are of a nylon and formaldehyde resin, "Delrin,"[1] having a relatively high strength and a low coefficient friction.

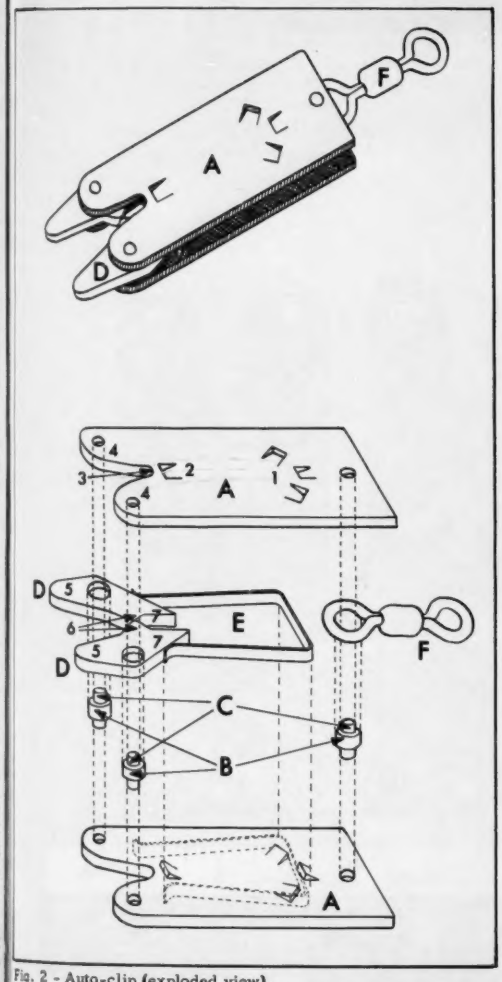


Fig. 2 - Auto-clip (exploded view).

A. Body plates	1. Spring guide projections
B. Bushings	2. Jaw stop projection
C. Rivets	3. Slot or throat
D. Jaws	4. Ears
E. Spring	5. Jaw lips
F. Swivel	6. Jaw teeth
	7. Jaw points

Pivotally mounted on the bushings between the body plates are the jaws (D). The jaws are of identical shape and are assembled in a mirror-image relation. The jaws have rounded lips (5), which extend beyond body plates. The jaw teeth (6), in closed position, extend across throat of body plate, terminate in jaw points (7), and form an enclosure with the throat within which is secured the longline. Pivotal movement of the jaws is limited by contact of jaw points with jaw stop.

The jaws are held normally in a closed position by pressure exerted by ends of the spring (E). Force exerted by a rope or line within the enclosure formed by the jaw teeth and throat tends to act with the spring pressure, causing the jaws to close tightly. The spring is a flat strip of corrosion resistant 304 stainless steel bent to be held in position by spring guide projections. The ends of spring are curved to provide a sliding contact with outside edge of jaw points. The swivel (F) pivots freely around bushing and rivet at back end of clip. The clip is finished in a flat black hardcoat anodizing to reduce its attractiveness to fish and prevent longline damage caused by fish striking it.

Other important features of the clip are weight, tensile strength, shape, and size. Weight is minimal ($3\frac{1}{2}$ ounces) through use of aluminum in its construction. Tensile strength has been tested to exceed 1,000 pounds, which equals or exceeds strength of any other branchline components. Shape and size (Fig. 3) have been designed to: 1) fit the hand for manual operation, 2) adapt to mechanical indexing and orientation, and 3) adapt to mass production manufacturing processes.

The mechanical principles are not new; the application of these principles, through concept and design of the auto-clip, is new to

[1] Trade names do not imply endorsement of commercial products.

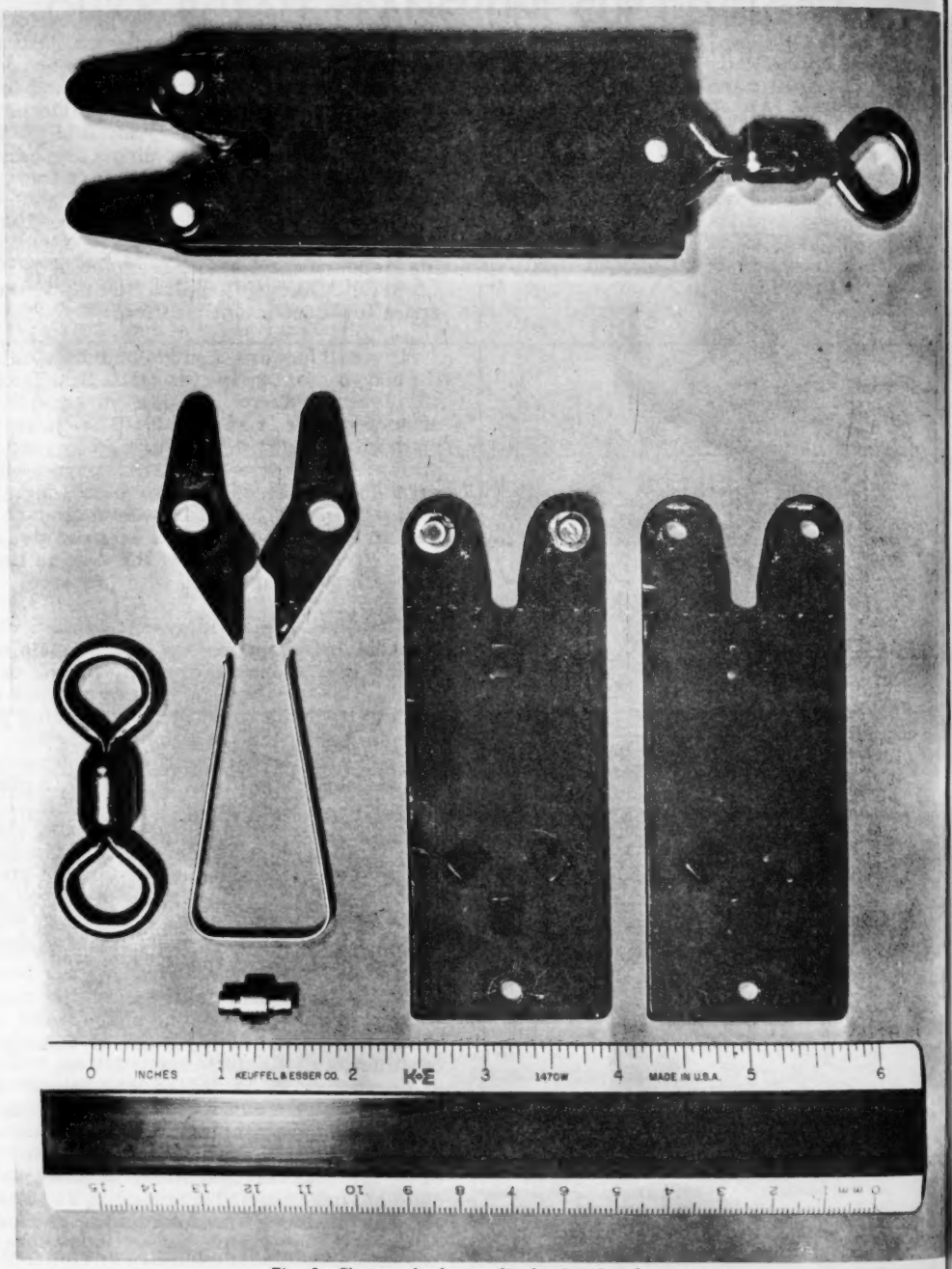


Fig. 3 - Photograph of auto-clip showing size of components.

fisheries. Other applications of this attachment principle are the semitrailer truck tractor-to-trailer hitching device and German Rolleiflex strap-to-camera hitch. Although these devices operate similarly to the longline auto-clip, their application and design are different.

THEORY OF OPERATION

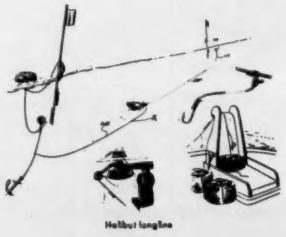
The longline auto-clip is an integral part of longline fishing gear: It is one component of the branchline consisting of clip, line, leader, and hook. The clip is connecting link of branchline for its attachment to longline. Buoylines are also attached by auto-clips to the longline at intervals of several branchlines, and are connected to buoys on sea surface above--thereby suspending fishing gear below sea surface. The line component of the branchline, or buoyline, is connected to the barrel swivel, which permits rotation of the line.

During setout of the fishing gear, the longline is payed out behind the moving vessel. Baited branchlines are attached either mechanically or manually to longline by pushing clip onto moving longline. As longline is inserted between jaws of clip, the jaw teeth are forced apart against spring tension. This allows longline to slip past jaw teeth and into throat of the clip. Once longline is in throat of clip, the jaw teeth snap shut under pressure of the spring.

The branchline attached by auto-clip cannot slide horizontally along the longline unless the auto-clip is precisely perpendicular to the longline. At any other angle to the longline, the clip "grabs" the longline to prevent slippage. This feature permits longline construction without knots or hardware to hold branchlines at their spaced positions--and it also permits flexibility of longline gear change by enabling metered branchline and buoyline attachment to the longline. This flexibility is virtually impossible with other clips or methods that require a pre-knotted longline for positioning and holding of branchlines and buoylines. The "grabbing" action of the auto-clip does not cut or fray the longline under normal (fish) pressures because of the rounded edges of the clip components.

When longline gear is retrieved, the clip-attached branchlines and buoylines approach from various angles and under varying tensions--depending on catch, weather, sea, and vessel maneuvering. Regardless of approach angle or tension, clip-attached branchlines and buoylines may be readily released from the longline either mechanically or manually. If operation is mechanical, the longline is directed through a fairlead sheave designed to orient, detach, and catch the clips with their attached lines. If detaching operation is manual, or if branchline is snarled about the longline preventing mechanical detachment, the fisherman removes the clip by grasping it with one hand and closing the protruding jaw lips. The thumb and forefinger of either hand, whether gloved or not, can readily close the jaw lips at a grab. This act releases the clip and, simultaneously, deflects it away from mainline. The fisherman does not have to take hold of the clip to release it.

Use of the longline auto-clip reduces and possibly eliminates manual handling of longline gear. The result is to improve safety aboard vessels, reduce labor requirements, and increase speed and efficiency of the fishing operation.



Halibut longline

A REMOVABLE DECK-BLOCK MOUNTING PAD

Michael G. Corbett

Equipping the BCF research vessel 'Delaware II' with a stern fished hydraulic jet dredge for survey work on ocean quahog, Arctica islandica, required that a block be mounted at the stern in the middle of the trawl passage. The purpose of the block is to provide a lead forward to the trawl winch for the quahog dredge haulback wire. On the Delaware II, the hydraulic dredge is hauled up the stern ramp.

It was expected that this block would be required only for the few cruises on which the hydraulic jet dredge was used. On non-clam cruises, the block would be in the way and obstruct trawling operation. Rather than weld a pad to the deck and burn it off each time, it was decided to make a quickly removable block mount and cover the space when the pad was not in use.

Figure 1 shows the block mount assembly. Its removable parts consist of the pad with its attached mounting bolt (part no. 1), gaskets, the bottom retaining washer (part no. 3), a nut,

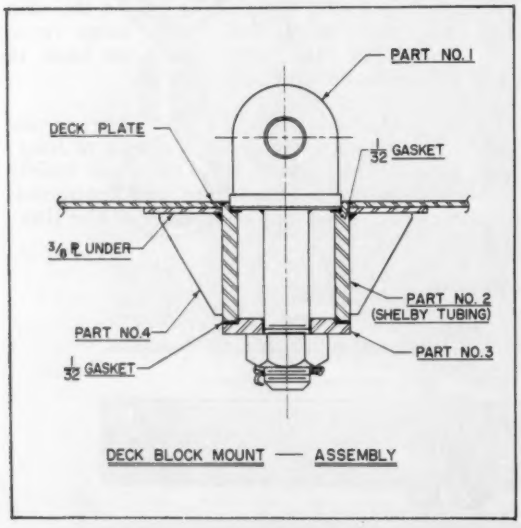


Fig. 1 - Drawing of assembly.

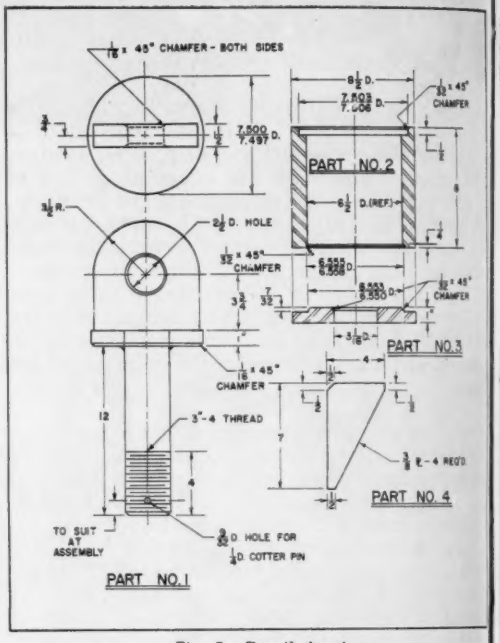


Fig. 2 - Detail drawing.

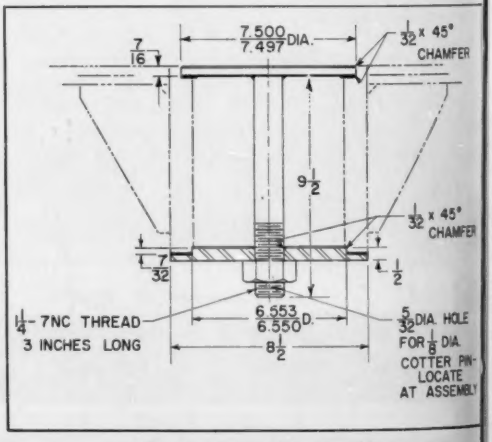


Fig. 3 - Cover plate assembly.

Mr. Corbett is Mechanical Engineer, BCF Exploratory Fishing and Gear Research Base, Gloucester, Mass. 01930.

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Fish and Wildlife Service
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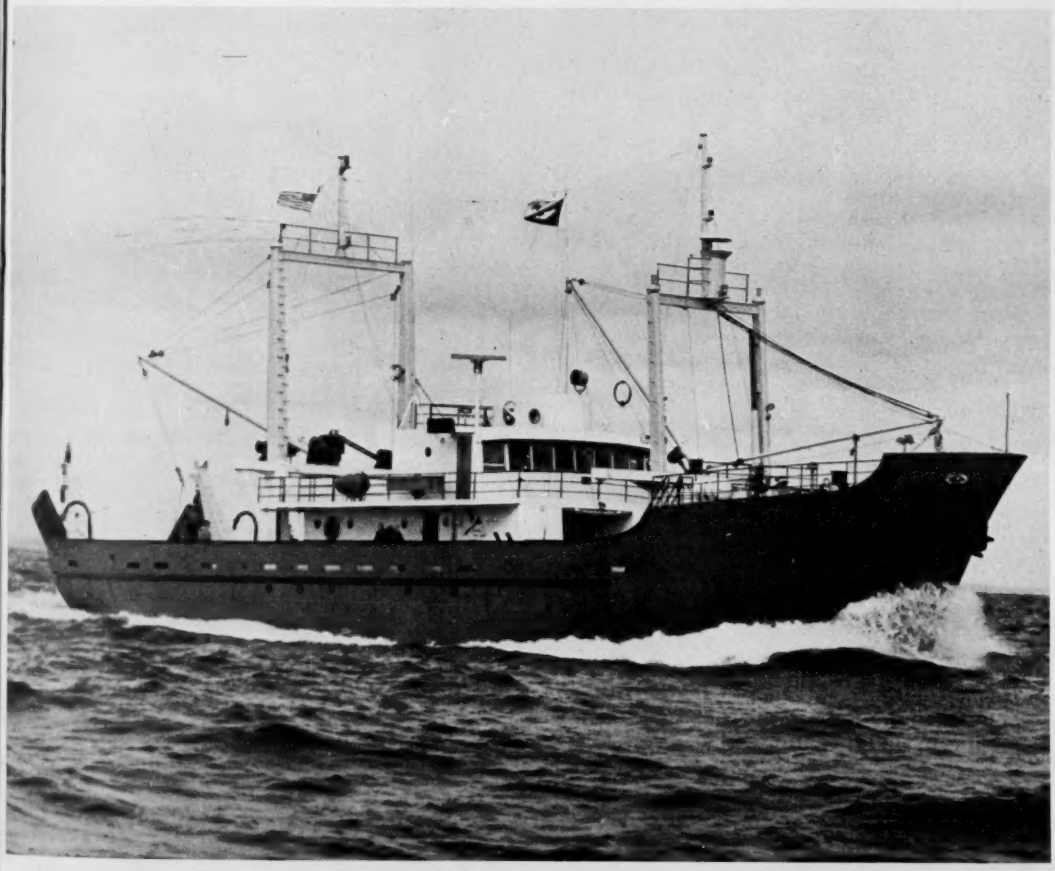
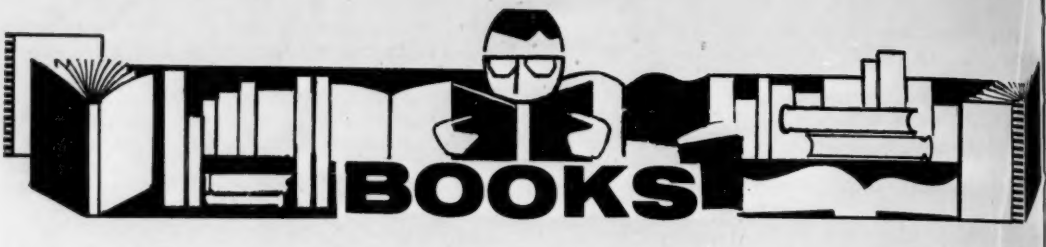
and a cotter pin. Permanently welded to the deck plate are a reinforcing plate and a flush-mounted length of seamless tubing (part no. 2) with gussets (part no. 4).

Figure 2 is a composite detail drawing of the components, which can be used to duplicate the assembly. Most of the dimensions could be modified to suit any specific situation.

Figure 3 shows the cover plate that mounts flush with the deck when the pad is not in use. It has its own washer, nut, and cotter pin.

The removable deck-block mounting pad worked well. The pad could be turned in any direction before tightening to accommodate the required lead for a particular job. If this feature was not needed or desirable, the pad could be keyed to lock it in place.





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SHRIMP

"Contributions to the Life History of Several Penaeid Shrimps (Penaeidae) Along the South Atlantic Coast of the United States," by William W. Anderson, SSR-Fish. No. 605, May 1970, 24 pp.

Shrimp is the most valuable fishery resource of the U.S. south Atlantic coast. In 1966, shrimp contributed 40% of the $27 million exvessel value for all fishery landings in this area. Three species of shallow water penaeid shrimp are of greatest commercial importance: white shrimp, Penaeus setiferus; brown shrimp, P. azticus; and pink shrimp, P. duorarum. Information is also included on the seabob.

This report reviews the shrimp fishery for trends in yield--for the area as a unit, by states, and by species for the 10-year period 1958-67. Data are presented on size distribution, ovary development, sex ratios, and spawning seasons.

"A trend toward steady decline in total shrimp landings is indicated."

SCOMBRID FISHES

"Size, Seasonal Abundance, and Length-Weight Relation of Some Scombrid Fishes from Southeast Florida," by Grant L. Beardsley Jr., and William J. Richards, SSR-Fish. No. 595, May 1970, 6 pp.

One of the major centers for saltwater sport fishing in the U.S. is along the coast of Florida from Palm Beach to Key West. The BCF Tropical Atlantic Biological Laboratory (TABL), Miami, sampled 7 species of scombrid fishes received from sport fishermen for mounting by taxidermist. Sampling was to determine seasonal presence of scombrids in this area to compare with sampling of their larvae in the Straits of Florida.

The species studied were: wahoo, little tuna, skipjack tuna, king mackerel, Spanish mackerel, and blackfin tuna. Length-weight relations, calculated weights at given lengths, size distribution, and seasonal abundance are presented in this paper for each species.

A FLORIDA BAY

"The Flora and Fauna of a Basin in Central Florida Bay," by J. Harold Hudson, Donald M. Allen, and T.J. Costello, SSR-Fish, No. 604, May 1970, 14 pp.

Florida Bay, located at the southern tip of the Florida peninsula, serves as a nursing ground for pink shrimp. This paper is a study of Porpoise Lake, a basin in the central part of the bay. Samplings were taken of the area, which is known to contain 196 species of plants and animals. A detailed description and listing of the species is presented, but no attempt is made to relate these organisms to the environment, except in very general terms.

HAWAIIAN SKIPJACK TUNA

"Distribution of Fishing Effort and Catches of Skipjack Tuna, Katsuwonus pelamis, in Hawaiian Waters, by Quarters of the Year, 1948-65," by Richard N. Uchida, SSR-Fish. No. 615, June 1970, 37 pp.

The report is based on "detailed data on catch, location, and effort obtained each year from all vessels that fish full time for skipjack tuna in Hawaiian waters." It summarizes the amount of "effective" fishing--trips when skipjack tuna are caught--the catch, and catch per standard effective trip.

Fishing for skipjack is "highly seasonal." The effort and catch in first quarter usually were 15% and 9% of annual totals. In May, fishing intensified. Second-quarter catches, by 32% of annual effort, produced 33% of annual catch. In third quarter, effort increased to 36% of annual total--and catches increased sharply to 46% of annual take.

Abundance declined in fall, and so did fishing. Fourth-quarter figures: 15% of annual effort and 12% of annual catch.

SONAR

"Studies on Continuous Transmission Frequency Modulated Sonar," by Frank J. Hester, SSR-Fish. No. 607, June 1970, 26 pp.

In 1961, the Inter-American Tropical Tuna Commission proposed a catch quota for the overfished yellowfin tuna stock. This quota could be increased if fishing for small yellowfin (less than 25 pounds) could be controlled. However, it is difficult to determine the size of fish before caught, and an attempt had never been made.

The BCF Tuna Resources Laboratory conducted a study from 1963-68--designing and constructing a shipboard sonar with fine echo frequency discrimination that could locate and classify fish schools. The equipment performed as theory predicted, but difficulty with sea noise and maintaining contact with fish schools showed additional work was necessary for commercial application. This report discusses these problems, some results, recommendations, and target-strength measurements for several species of fishes.

CHUM SALMON

"Synopsis of Biological Data on the Chum Salmon, Oncorhynchus keta (Walbaum) 1792," by Richard G. Bakkala, FAO Fisheries Synopsis No. 41, Circular 315, March 1970, 89 pp.

Chum salmon have the widest distribution of any Pacific salmon. They inhabit widely different environments during their life, returning to spawn in the river from which they originated. The chum spawns in 5 countries: the U.S., Canada, Japan, Korea, and USSR; they are most abundant on the Asian continent.

Bakkala reviews nomenclature, taxonomy, morphology, distribution, ecology and life history, population dynamics, fishery, and protection and management of the chum.

NORTHERN SQUAWFISH

"Laboratory Tests of an Electrical Barrier for Controlling Predation by Northern Squawfish," by Galen H. Maxfield, Robert H. Lander, and Charles D. Volz, SSR-Fish. No. 611, July 1970, 8 pp.

Northern squawfish prey extensively on young sport and commercial fishes. During early spring and summer, they prey heavily on salmon (Oncorhynchus spp.). The salmon are released from upstream hatcheries on Columbia River and must run gauntlet of squawfish-infested areas on way to sea.

Controlling these predators requires finding a way to block their entry into release areas of hatchery-reared salmon--without interfering with salmon migration.

The authors "explored in the laboratory effectiveness of electrical fields previously found to direct the movements of salmon fingerlings."

TRAVELING SCREENS

"Preliminary Designs of Traveling Screens to Collect Juvenile Fish," SSR-Fish. No. 608, July 1970, 15 pp.

Biologists and engineers have been studying the problem of protecting juvenile salmon, shad, and striped bass from destruction in rivers with dangerous hydroelectric or irrigation developments. They have studied possibility of deflecting fish from their normal routes to alternate routes around dangerous areas.

Many methods of deflecting fish were examined: bands of rising bubbles, curtains of hanging chains, electrical stimuli, lights, etc. Although efficient under certain conditions, these were never completely reliable.

The traveling screens described in the report were developed to overcome these disadvantages. A traveling screen is a conveyor belt placed on edge diagonally across path of juvenile fish migrating downstream--and so are guided into bypass at downstream end of structure.

"Two horizontal traveling screens were designed and operated for 2 years at the Carson National Fish Hatchery, Carson, Wash... The screens demonstrated their potential capacity to divert young salmon moving downstream."

PACIFIC SALMON COMMISSION

"International Pacific Salmon Fisheries Commission Annual Report 1969," 53 pp.

The International Pacific Salmon Fisheries Commission held 15 formal meetings during 1969, with approved minutes submitted to the U.S. and Canadian Governments. This report reviews the meetings and recommendations for regulations governing the 1969 sockeye and pink salmon fishery for U.S. and Canadian Convention Waters. Summaries of catch and escapement of sockeye and pink salmon are also presented.

INTERNATIONAL

EUROPEAN COMMON FISHERIES POLICY ADVANCES

The Common Market's (European Communities') Agricultural Ministers agreed in principle on June 29 to introduce a common fisheries policy before Nov. 1, 1970. The six member countries originally agreed on an April 30 deadline, but disagreement between France and others postponed it.

French Pressure on EC

France had maintained that fishery policy should be completed before negotiations starting June 30 for entry of countries into Common Market. The other member countries advocated postponement until Denmark and Norway, at least, could join negotiations. However, under French pressure, the Agricultural Ministers adopted on June 29 the framework of a common fisheries policy. Denmark and Norway expressed disappointment that they were not consulted.

Limiting Fishing Proposed

To expedite adoption of policy before entry negotiations, the EC Commission proposed limiting fishing within 3-mile territorial limit for not over 5 years. During this period, the Commission would investigate problems and propose to the Ministerial Council supports designed to assure income of coastal population dependent on this fishery. (U.S. Embassy, Copenhagen, July 9.)

ICNAF HOLDS 1970 MEETING

Delegates from 14 member countries attended the 20th annual meeting of the Northwest Atlantic Fisheries Commission (ICNAF), St. John's, Newfoundland, June 1-6, 1970. Observers from FAO, ICES, and Japan were present.

The Commission approved proposals for: (1) international inspection, (2) regulation of yellowtail flounder fishery in Subarea 5, (3) modification of mesh-size regulations in Subareas 2 and 3, (4) regulation of seal harvest off Canada, and (5) additional regulation of salmon fishery throughout Convention area. Regulatory proposals become effective within about 6 months if there are no objections.

International Inspection

International inspection procedures would enter into force July 1, 1971. Inspection officers of an ICNAF country would be allowed to board vessels of another member. Observance of applicable ICNAF recommendations could be verified. Infringements would be reported to country of vessel concerned for further handling.

Yellowtail Flounder Fishery

For yellowtail flounder, the proposals would apply quota and trawl regulations in Subarea 5. Quota would limit catches during 1971 to: (a) 16,000 metric tons from grounds east of 69° W. long. (b) 13,000 metric tons from fishing grounds west of 69° W. long. After any closure required by quota, vessels affected would be allowed incidental catches of yellowtail flounder not over 5,000 pounds, or 10% of their total catch in area. This is the same now provided for haddock and cod.

The trawl regulation proposed would extend trawl regulations in Subarea 5 to yellowtail flounder. Mesh sizes at least $4\frac{1}{8}$ inches (synthetic fiber) would be required.

The Commission also asked ICNAF scientists to assess further yellowtail flounder resource during coming year so Commission can consider regulatory adjustments in 1971.

Modification of Mesh Size

The Commission recommended that mesh size required for regulated species in Subareas 2 and 3 be increased from $4\frac{1}{8}$ inches to $4\frac{3}{4}$ inches (synthetic fiber). Proposed date of entry into force for requirements is July 1, 1971. Present exemption for redfish (ocean perch) fishing in Divisions 3N, 3O, and 3P of Subarea 3 will be continued under proposed new requirements.

Harp Seal Harvest Limit

The Commission proposed a harvest limit of 245,000 harp seals from ice pack off Canada in 1971. This is first time Commission has approved quota for seal harvest.

The Commission also proposed that 1971 open season for harp and hooded seals begin not earlier than March 12, and close not later than April 24.

Salmon Fishery

Several ICNAF countries did not accept 1969 proposal for ban on high-seas fishing for salmon outside national fishery limits. As interim measure, Commission has proposed that countries fishing for Atlantic salmon freeze size of their fleets and level of catch at 1969 level. This freeze would apply during 1971 and be reviewed further in 1971.

1971 Annual Meeting

The 21st annual meeting of the Commission will be held in Halifax, Nova Scotia, Canada, May 25-June 5, 1971.

USSR & JAPAN TO DISCUSS 'SAFE-FISHING OPERATIONS' IN NORTH PACIFIC

On July 14, the Japanese Ambassador to Moscow presented a plan for operation, free from Soviet seizure, of Japanese fishing vessels around Soviet-held islands of Habomai, Shikotan, Kunashir, and Iturup off Hokkaido.

Plan highlights are:

(1) Japanese fishermen shall operate without Soviet interference inside 12 miles around the 4 islands, but not within 3 miles of coastline; (2) Japan is willing to comply "as much as possible with countermeasures that may be devised by the Soviet Union regarding the operation free from seizure of Japanese fishing vessels"; and (3) the Japanese vessels in the "safety zones" will be mainly those that operated there before.

Negotiations between USSR and Japan are scheduled for Moscow in September 1970.

Many Seizures Since 1946

The Soviet Union has been holding the 4 islands since World War II. She has promised to return Habomai and Shikotan when a Soviet-Japanese peace treaty is negotiated. However, she appears adamant about retaining Kunashir and Iturup, but Japan is not abandoning her claim.

The Soviet Union claims a 12-mile territorial limit, and has seized all Japanese fishing vessels and crews in those waters. Between 1946 and 1969, the Soviets apprehended over 1,300 Japanese fishing vessels and nearly 12,000 Japanese fishermen. Over 20 Japanese vessels were sunk and 32 fishermen drowned in those seizures. Three vessels and 8 fishermen are still being held.

Soviets Seek Japanese Aid

According to Japanese sources, the Soviets are eager to get Japanese financial and technical assistance to expand their Far-Eastern facilities for processing, preserving, and distributing fishery products. The Japanese expect the Soviets to ask for this assistance as a price for granting fishing rights off the 4 islands. ('Kyodo,' July 15; 'Japan Times,' July 15 & 16; 'Yomimuri,' July 14.)

FISH CULTIVATION MAY INCREASE 5 TIMES BY 1985

World fish cultivation has grown to roughly 4,000,000 metric tons of fish and shellfish. It could expand to 20,000,000 tons by 1985, according to FAO estimates.

If achieved, it would help to provide better diets and protein-rich foods in developing areas, especially where malnutrition is aggravated by a steadily increasing population. "Aquaculture, often in combination with agriculture, is a promising means of exploiting fish as a source of highly nutritious, inexpensive proteins," FAO says.

Based Partly On Questionnaire

The estimates are contained in the current FAO Fish Culture Bulletin. They are based on questionnaires sent to governments and on available data.

The authors of the article emphasize that the research is tentative and suitable statistics are lacking, especially for shellfish culture.

"We do not claim a high degree of accuracy for the above figures. . .but believe that they indicate at least roughly the magnitude of the industry." The figures are an estimate of average national production in recent years.

In Indonesia, breeding fish involves 200,000 Javanese. Fish and rice are staple diet. FAO encourages raising fish in ponds. (Photo: UNations)

The study estimates finfish cultivation in 36 countries, producing 100 tons or more, at 3,000,000 metric tons. The remaining one million is a composite of shellfish production for all countries.

Asia No. 1

Mainland China is first among the 36 nations with 1,190,000 metric tons. Japan is second with 487,000 tons, followed by India with 480,000 tons, and the USSR with 190,000 tons. Of the 3 million tons, more than 2,600,000 came from 9 countries of Asia and the Far East.

The FAO Bulletin states: "This shows the unequal distribution of the industry in the world. In the continents of Africa and South America, aquaculture is in its very early infancy and probably those regions have the maximum area available for cultivation of fresh and brackish-water species. Even in Asia and the Far East, which produce the major proportion of cultivated fish, there appears to be considerable scope for expansion. For example, in the Philippines, Indonesia and India, which already have a total of about a million hectares under culture, there is still an estimated area of about 8.2 million hectares that can be reclaimed for fish culture."

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COMMUNIST CHINA & JAPAN CONCLUDE 'PRIVATE' FISHERY AGREEMENT

On June 20, in Peking, Japan and Communist China extended for 2 years their nongovernmental agreement on the fisheries in East China and Yellow Seas. The new agreement was signed only 2 days before the old one expired. It was the first time since Dec. 1965 that the 2 countries have conducted full negotiations.

Political Aspects

The joint communique included: condemnation of Sato government's policies toward U.S. and Asia, renewal of U.S.-Japan security treaty, U.S. intervention in Cambodia, and "revival of Japanese militarism and expansionism." The Chinese press claimed "sabotage activities" by a handful of reactionaries in Japanese fishing circles and violation of earlier agreements had hampered negotiations.

Japanese Eager for Agreement

The Japanese catch in the agreement area is about 700,000 metric tons. So the Japanese negotiators accepted all political demands. The new agreement will run longer than previous ones. It includes new clauses on fishing practices and conservation.

Regulations

Supplementary regulations include: clear designation of vessel names, better "surveillance procedures for violators," stricter punishment of offenders, seasonal ban on "Taisho" shrimp fishing, restrictions on trawl fishing, and a ban on "tackle-net" fishing. "Tackle-net" gear is believed to be stick-held dip net (Boke ami).

Ban on Tackle-Net

The tackle-net ban is most controversial item of the new agreement because the Japanese use it to catch about 400,000 metric tons of mackerel and horse mackerel. The Chinese do not use tackle-nets. Their demands for ban are attributed to "showy fishing methods of big (Japanese) fishing fleets" whose "fish-attracting lights irritate the Chinese."

The Japanese also agreed to pay US$55,600 as "reparations for 20 cases of injury."

Japanese News Media Favorable

Reaction of the Japanese news media has been generally favorable. They have played down political aspects in favor of what is felt to be real progress in management of East China Sea and Yellow Sea fisheries. Though "private" negotiations may frequently be cumbersome and useless, the Japanese Government supports them. They will continue until Japan and China restore diplomatic relations.

CANADA

NEWFOUNDLAND PLANS DEVELOPMENT PROGRAM

The development of new catching methods and intensified search for unexploited stocks are among major items of the about C$1 million 1970 federal-provincial program for Newfoundland fisheries.

The program calls for introduction and demonstration of new and improved fishing gear and fish-processing equipment; exploration for more pelagic fish (herring, sand launce, and capelin), shellfish, and Irish moss; and technical demonstrations to fishermen.

New & Traditional Methods

Newfoundland fishermen will be made familiar with new and traditional methods. A large side trawler will test feasibility of using seine-netting gear on this type of vessel, particularly for flounder on Grand Banks.

Bottom Trawls on Stern Trawlers

Bottom trawls (Atlantic western trawls) will be built in Newfoundland and their ability on stern trawlers demonstrated. These trawls have been successful on side and stern trawlers in other areas. They have very high vertical openings permitting catch of more high-swimming bottom fish than conventional bottom trawls. They are more effective on rough ground, and repair costs are much less.

Exploration & New Traps

Two large vessels will explore for herring, sand launce, and capelin off Newfoundland. New types of capelin and herring traps will be demonstrated to fishermen in Ferryland area and Placentia Bay, where crabs will be explored. Experiments with cod traps of synthetic materials and Japanese-designed, low-cost, fish-catching and handling devices will continue. (Fisheries Council of Canada, June 1970.)

* * *

SALTFISH CORPORATION CREATED

On April 1, Canada set up the Canadian Saltfish Corporation as the sole marketing organization for saltfish. Headquarters is St. John's, Newfoundland.

During its first year, the corporation will follow most policies already set by commercial markets. At the same time, however, it expects to plan the development of new markets and products for the consumer in 1971.

Explores New Ideas

The corporation is exploring new marketing ideas--boneless or semiboneless fish, consumer-ready portions, etc. It hopes to develop these in consultation with fishermen and marketing outlets outside Canada, particularly New York and Puerto Rico. (U.S. Consul, St. John's, Newfoundland, June 16.)

* * *

SALMON FLEET VALUE INCREASES

The number of vessels in British Columbia's commercial salmon fleet is decreasing, but replacements are adding to overall investment in fishing capacity. Jack Davis, Canada's Fisheries and Forestry Minister, froze the fleet in Sept. 1968.

This year, 6,581 vessels are registered--compared with 6,925 last year--a drop of 5%, but value has increased 3.3%, or C$3 million.

Davis Disappointed

Davis was disappointed in results and hinted further restrictions to limit continued value increase. He said: "With a good season in 1970 there is the danger that boat construction will pick up and tonnage rise. We must prevent this from happening and I therefore plan to make a further announcement soon about salmon vessel replacement."

Regulations

It is now mandatory to remove a "category A" boat from the fleet before bringing in another. Exceptions are boats under construction in 1968 and those lost at sea.

Value of Fleet

Value of the fleet in 1970 is $98 million, up $3 million from 1969. This includes $2½ million resulting from replacement of 112 "category A" boats by higher-value vessels; 8 vessels for $265,000 were brought into fleet along with 5 vessels for $165,000 built under Indian Fishermen's Assistance program this year.

CANADA (Contd.):

Company Boats Down By 60

Company-owned salmon vessels decreased by 60 this year. The minister wants these maintained at last year's ratio of 12% of total fleet. In 1969, company boats totaled 793 worth $12.5 million. In 1970, total dropped to 733 worth $13 million. Difference reflects higher value of replacement vessels. (Department of Fisheries, June 19.)

* * *

REPLACEMENT RULE ON SALMON VESSELS IS IN EFFECT

A ton-for-ton replacement rule to bring new category "A" boats into commercial salmon fleet has gone into effect. A fisherman who plans to bring a new boat into the fleet must have one with matching tonnage to take out--or a collection of smaller boats to equal that tonnage. However, if a large vessel is retired, only one new vessel can be licensed to replace it. Boats under construction at the time of announcement are excluded.

100% Increase in License Fees

Next year, there will be a 100% increase in salmon-fishing license fees for all "A" category vessels, except smallest class (29 feet and under), which remains $100. Boats over 30 feet, but less than 15 tons, go from $100 to $200; those over 15 tons from $200 to $400.

Owners of category "A" vessels can drop back to "B" category and pay the $10 license fee; this license has a 10-year terminal date.

License fees were raised this year to set up a "buy-back" fund to allow government to buy salmon vessels offered on the market. It stands at C$0.5 million today; next year's fees will add $1 million.

Present Regulations

Present regulations, set Sept. 1968 when the salmon fleet was frozen, allowed a boat-for-boat replacement. Since 1968, there has been a reduction of 788 vessels in the fleet, but only a slight reduction in tonnage. This was caused by larger higher-powered vessels replacing smaller category "A" boats and boats under construction when freeze was announced.

The initial freeze increased value of category "A" boats. Company ownership of salmon boats was curtailed by setting a ratio of 1:8 to total fleet. Fleet reduction will speed up, and fishermen should see improved economic returns for their work and investment. (Dept. of Fisheries, June 26.)

* * *

HERRING STOCKS OFF BRITISH COLUMBIA RECOVER RAPIDLY

Although herring stocks off Canada's west coast, at a low ebb since disastrous season in 1968, are rapidly recovering, there will be no commercial reduction fishery this year.

The herring spawn deposit was 270 miles, more than twice the mileage in 1969 and greater than 25-year average of 204 miles.

Herring Move Inshore

In the fall, herring move inshore and, during the spring, spawn along shoreline. It requires 250,000 tons of herring to produce spawn deposit found this year. Eggs are found on vegetation and 500 eggs may be attached to an inch of eel grass.

Small Surplus

Dept. of Fisheries regional director said there will be a small surplus this winter above spawning requirements, but not sufficient to bring an economic return to fishermen. The advisory group said a greater effort should be made to encourage development of a herring food industry.

In 1963, the peak herring season, more than 250,000 tons were harvested. Production decreased to 133,000 tons in 1967, and to 18,000 tons in 1968. (Dept. of Fisheries of Canada, June 23.)

EUROPE

EUROPEANS LOOK TO U.S. FOR FISHERY PRODUCTS

Despite fairly good supplies of locally caught fishery products, European markets increasingly are finding insufficient supplies of certain species to meet demand. But it is rising consumer demand that causes rising price trend in this already high fish-consuming area. With the inability of European fleets to supply adequate quantities, buyers are looking for other sources.

U.S. Shrimp Sales Double

Since 1964, U.S. shrimp sales to Europe have doubled each year. In 1969, frozen shrimp, mainly from Maine and valued over US$5 million, were sold largely to Sweden. Shrimp from Alaska now is entering the markets. Markets in Norway and Denmark also are taking more. In Norway, shrimp fishermen have been concerned somewhat by the low prices, which undercut their sales; they are now seeking ways to improve marketing.

Eels Popular

Eels are another U.S. product gaining sales in Europe. For some years they have been selling in the Netherlands but, recently, active buying interest was found in West Germany and Denmark. U.S. producers have found market possibilities excellent.

New Demand for Crayfish

Each year, during early August, Scandinavian festivals require tons of freshwater crayfish. In the past, these have been obtained from Turkey, other southern European countries, and locally. These supplies are no longer adequate. This year, for the first time, crayfish from the U.S. Pacific Northwest are being shipped to Scandinavia.

Herring Wanted

Herring packing plants in West Germany use large quantities of fresh and frozen herring in their preserved snacks. Herring supplies are short in Europe, so they seek them from fisheries off the U.S. and Canada. A new filleting plant opened recently in Massachusetts to pack shipments for German and Scandinavian markets. (U.S. Embassy, Copenhagen, Aug. 13.)

WEST GERMANY

FACTORY TRAWLER LANDS 780 TONS OF FILLETS

The new West German factory trawler 'Sonne' set a record for Bremerhaven with a landing of 780 metric tons of cod, redfish, and saithe fillets--and 308 tons of fish meal produced from a catch of more than 2,000 tons. The Sonne record was made on an 83-day trip that spanned northern waters of North Atlantic.

Completed in March 1969, the vessel is 284 ft. long, has 3 machine processing lines, and can fillet and freeze 40 tons of fish a day.

Switch-Fishing Vessel

Like some other large German stern trawlers, she is a switch-fishing vessel. She can change in about 30 minutes from bottom to midwater gear. She has a complex array of acoustic fish-finding devices.

From her maiden trip, the Sonne brought back 625 tons of fillets from a catch of 1,600 to 1,800 tons. The second trip produced 725 tons of fillets. On the third trip, she went after herring in northwest Atlantic. She returned in Dec. 1969 with the fillets from a 2,000-ton catch. Her fourth trip produced about 600 tons of fillets.

Exceeded Fish-Room Capacity

On Mar. 4, 1970, the Sonne left St. Pierre and trawled off Labrador, West Greenland, and in Barents Sea. Towards end of May, her fillet production began to exceed the 750-ton capacity of her fish rooms; the surplus had to be put into provision rooms.

The price paid for her record landing was not revealed, but she earned over US$360,000 from her latest voyage. ('Fishing News', June 2.)

IRELAND

1969 WAS BEST YEAR

In 1969, according to Department of Agriculture and Fisheries, the Irish fishing industry enjoyed its best year ever. Catch value of sea fish (excluding salmon) was US$7.2 million, a 24% increase over 1968.

Exports are rising steadily due to increase in landings and new marketing patterns that are improving prices and providing exporters with new opportunities.

Between 1968 and 1969, exports rose from 25,094 to 52,576 metric tons and value from $6.4 to $8.5 million. Varieties accounting for increase were herring, lobster, shrimp, scallops, and oysters.

Research & Development

Research and development are opening possibilities. Development work on mussels resulted in 10% increase in production and 25% rise in value of landings. Oyster production jumped 72% and value 122%. Crab landings of 600 tons, worth $96,000, were processed at new plants along coast. Including value added by processing, this crab meat netted about $240,000 in exports.

Due to uncertain landings and sizes, industry has not shown enough interest to fulfill potential.

Encouragement by Government

One main objective of Sea Fisheries Board in trying to resolve this situation was to stimulate onshore activities.

A first step was to improve size and quality of fishing fleet. It has been doing this by providing grants for boat building, equipment, and gear. Investment in vessels grew from under $1.2 million in 1968 to $2.4 million in 1969. The latest projection sees an annual investment rate of $3.8 million by 1972.

To complement investment in vessels, the Board tried to persuade individuals and companies to invest in industry. It was only achieved by introducing a high-powered marketing style tailored to individual needs. Since mid-1967, this approach has met with some success--new investments total $3.2 million and new companies 17. Eleven companies are completely Irish, 5 have foreign participation, and one, a fish-meal factory, is owned by a Scottish firm.

Another 30 projects are said to be under construction. (U.S. Emb., Dublin, June 17.)

ICELAND

HERRING CATCH FELL 60% IN 1969

Iceland's 1969 herring catch was 56,893 metric tons, a decline of 60% from the 142,820 tons in 1968. Only 87 vessels fished; in 1968, 119.

The 1969 catch:

Where Caught:	Metric Tons
Southwest of Iceland	22,111
North Sea	21,926
Off U.S. East Coast	12,785
Arctic Waters	71
	56,893

Use of Herring Catch

	1969	1968
	Metric Tons	
For Freezing	4,177	7,776
Salting	19,379	28,834
Canning	1,266	1,451
Reduction	3,808	55,712
Landed on Ice	28,078	49,204
Other	185	157
	56,893	142,820

Mostly between June and October, 6 vessels fished herring off U.S. east coast. The 12,785 tons caught were transferred to freighters outside 3-mile limit for transfer to shore reduction plants. Catch value was US$197,000. (U.S. Emb., Reykjavik, July 7.)

DENMARK

COLDER CLIMATE WILL AFFECT FISH STOCKS

Greenlandic industrial life may be seriously affected by a rapidly changing climate. In all probability, weather will get colder during next 10-20 years; a new mild period is not expected until next century. This prediction by H. C. Ørsted's Institute, Copenhagen, is based on studies of core drillings east of Thule.

Further Investigations Planned

If further investigations confirm this, Denmark's investment policy in Greenland would have to be altered, an official said. Of primary concern is the possibility that cod stocks would move south, and Greenlanders would have to find new catch areas to maintain their plants.

U.S. to Aid

Recently, the National Science Foundation, Washington, announced US$1.2 million would be available for research in ice-cap borings to determine previous climatic trends. New investigations must be carried out with aid from U.S. because Denmark does not possess necessary equipment for drilling inland ice.

Milder Climate Better for Fish

Milder climate, which prevailed from late 1800s up to 1930, caused a decline in seal and whale catch but provided better conditions for fish. By end of 1930s, however, signs of a decline in temperature appeared before man had an opportunity to use fully the new fishery wealth. In the 1950s, there was evidence of a significant rise in sea temperatures, but not to level of the 1930s. Recent poor cod year-classes are believed result of new temperature declines. (U. S. Emb., Copenhagen, June 30.)

NORWAY

SEEKS CONTRIBUTIONS TO 'NORWEGIAN SALMON SHOP'

The head of the Norwegian Directorate for Fish and Wildlife proposes that Norway start negotiations with other salmon-fishing nations for direct contributions to the operation of the "Norwegian Salmon Shop." He said Norway is carrying entire expense for cultivation of salmon-spawning grounds and inspection of fishing area--while other countries, especially Denmark, West Germany, and Sweden, catch Norwegian salmon.

He Proposes Contributions

The director proposes that these nations contribute to cultivation work in Norwegian rivers and inspection of fishing areas by contributing to fund that might be administered by his directorate. (U.S. Emb., Copenhagen, July 9.)

* * *

SARDINE PRODUCTION AND EXPORT TRENDS REPORTED

A few years ago, the winter herring kept canneries busy early in the year. Industry's raw fish need for kippers was only about 1% of season's catches. Things have changed. In 1969, total catch was not more than Norwegian industry could utilize; the situation is repeating itself in 1970. At auctions this year, fresh-fish buyers could outbid canning industry, which has been left with trifling quantities at prices 2 to 3 times higher than last year.

Despite this, the canneries have been able to maintain production fairly well, processing frozen raw material for sild sardines.

Exports Compare With 1969

Exports of sardines this year compare favorably with same period 1969. But exports

1969 Exports to Main Markets

	Jan.-Dec. 1967		Jan.-Dec. 1968		Jan.-Dec. 1969	
	Tons	US$1000	Tons	US$1000	Tons	US$1000
United States	11,506	10,109	12,355	11,066	12,331	11,636
Great Britain	4,931	3,763	4,340	3,459	3,568	3,047
Australia	1,891	1,416	2,006	1,602	1,918	1,571
South Africa	1,317	897	1,497	1,020	1,433	1,002
Canada	841	788	804	785	798	818
Sweden	2,034	1,427	2,124	1,461	2,638	1,711
Total	28,216	22,262	28,992	23,345	27,277	23,123

NORWAY (Contd.):

to biggest market, the U.S., were interrupted by U.S. longshoremen's strike in Gulf and East Coast ports during first months of 1969. ('Norwegian Canners Export Journal,' Mar.)

* * *

PURSE SEINERS MAY SEEK CAPELIN OFF LABRADOR

Some of Norway's largest purse seiners probably will fish capelin off Labrador--following research leader Finn Devold's report to the Norwegian Fisheries Association of large resources. The association advocates a guarantee of about US$5,600 to explore that fishery.

Would Fish During Summer

If research cruise is successful, the purse seiners will go off Labrador during the summer. It would then be necessary for mother-ships to bring raw material to fish-meal factories, particularly in northern Norway.

The capelin resources off Labrador are not exploited today. (U.S. Emb., Copenhagen, July 16.)

* * *

GOVERNMENT AND UNION SIGN AGREEMENT

The Norwegian Fisheries Department and the Fishermen's Union signed a one-year agreement in June to support the fishing industry, particularly where coastal populations would have trouble finding other jobs.

The agreement provides for US$34 million, down US$2 million from 1969's agreement, but about US$1.8 million above June 1968 agreement. These amounts do not include money provided specifically to support stockfish trade. The support proposed must be approved by parliament.

5-Year Program Fails

The year ending May 31, 1969, ended the 5-year period in which the union and government pledged to make the fisheries independent of State price support (General Fisheries Agreement of 1965). Actually, state price support has gained substantially since 1964-65. The agreement was based on assumption that support would result in a reasonable improvement in fishermen's incomes through greater efficiency. Incomes would have been unreasonably low without state financial aid.

Cod Fishery Aid

The new agreement, when approved, will be valid from June 1, 1970, until May 31, 1971. The support will involve US$8.7 million for cod fishery (US$8.8 million in year ended May 31, 1970), and US$5.3 million for herring fishery (US$9.5 million). Also, US$2 million (US$0.7 million) will be available to Fisheries Department for special support to cod fisheries, including stabilization efforts in case of unexpected market failures.

Subsidy Amounts

The estimated subsidy for cod will remain at 0.5 cent per lb.; mackerel and sprat for human consumption will get 0.6 cent/lb.; herring 0.7 cent/lb.; shrimp 0.5 cent/lb.; crabs 0.7 cent/lb.

The arrangement for freight subsidies from distant waters has been expanded to include Faroe Islands, Shetland Islands, Orkney Islands, and Irish Sea. Norway has been criticized for keeping prices artificially low by these support devices. (U.S. Embassy, Copenhagen, July 21.)

* * *

INCREASES MACKEREL EXPORTS TO U.S. & SWEDEN

Fifty thousand 400-gram packages of frozen mackerel fillets were scheduled for shipment to U.S. during July, the director of Norway's Mackerel Association reported. The association has been trying to develop the U.S. market. It looks forward to larger orders. The director expects to visit the U.S. later this year to learn more about market prospects.

Swedish Interest

Sweden has imported large packs of round mackerel during 1970. She is interested in this product. Market prices in Sweden are good, and sales are expected to increase. Frionor covers the market.

NORWAY (Contd.):

Netherlands

The Netherlands previously imported mackerel from Norway. She has been unable to meet the price increase during 1970. Because of 20% duty increase by European Communities on June 15, imports from Norway have practically stopped. The Netherlands now is importing French and Japanese mackerel.

New Foreign Markets Important

Norway learned in 1969 the importance of developing new markets abroad and increasing mackerel sales. The association believes it essential for Norway to deliver her own product to live up to standards foreign countries expect of her products. ('Fiskaren,' June 25.)

* * *

FACTORYSHIP TO OPERATE OFF NORTH COAST

The factoryship 'Norglobal', recently built from a bulk carrier, was slated to start fish meal and oil production in mid-July near Bear Island for summer capelin. The fishing operations at Bear Island will allow experts to break in the machinery before the vessel sails for the South Atlantic later this year.

Continuous Production

The production machinery will handle a maximum of 300 metric tons of raw material in 24 hours. Production will be continuous in 12-hour shifts manned by 25 men. The ship's normal crew is 60-65 men. The raw material storage capacity corresponds to 40 hours of full operation. The meal pellet storeroom can hold about 10,000 tons; the fish oil storerooms about 2,400 tons. The storerooms can be filled in one month if sufficient supplies of raw material are available.

It Will Be Mothership

The factoryship has the most up-to-date production and transport equipment. The ship's discharge pumps have a capacity of 800 tons of fish an hour and fully automatic scales. The fish meal is pelleted in four pellet presses; each handles hourly a minimum capacity of 8 tons of pellets. The vessel will be mothership to a purse-seine fishing fleet of 12 to 15. The vessel's products will be landed by transport vessels, which also service the expedition.

World's Largest

The Norglobal is the largest floating fishmeal factory in the world. It has a deadweight of 27,300 tons. Total investment is about US$7 million. Nordsildmel will market the products. (U.S. Embassy, Copenhagen, July 23.)

* * *

GROUP STUDIES AFRICAN MARKETS

A Norwegian fishery delegation recently visited 4 African countries to study market conditions, especially for stockfish in Nigeria. Up to now, governments have not permitted stockfish imports due to exchange problems. In Nigeria, a license to import Norwegian stockfish is expected to be issued, but the quantity is unknown. The delegation offered a government loan credit to Nigeria to buy stockfish, and a gift of some aid to areas hardest hit by the civil war. Nigeria was considering the offer.

Other Potential Markets

The Norwegian delegation found sales possibilities in Liberia, Ivory Coast, and Ghana. Excluding stockfish to Nigeria, Norway's fish exports to Africa have been minimal.

Seven Norwegian trawlers are fishing off Ghana.

The 4 Want Fishing Trade

The four countries visited are attempting to develop a fishing trade but lack know-how. Their governments contract with foreign trawlers, especially East European, to deliver frozen fish. A refrigerated distribution chain is being developed throughout the four countries.

Non-African Countries Active

The number of U.S. tuna vessels in the area has increased. The French fleet is particularly active in the Ivory Coast. Italy has offered aid to expand the fleets of the 4 countries. (U.S. Embassy, Copenhagen, Aug. 13.)

* * *

NORWAY (Contd.):

FRIONOR EXPECTS NEW FISH-FILLET RECORD IN 1970

The director of Norway's Frionor Frozen Fish A/L reports the freezer plants' frozen-fillet production and sales have never been steadier than now. Unless a raw material shortage occurs, last year's record production of 82,000 metric tons (200,000 tons of raw material) will be surpassed by far. During the first 5 months of 1970, production was running about 30% higher than in same period 1969, and plants were working full force without restrictions.

Presently, there are no stocks at the freezer plants because exports are in step with production. Market prices also continue to rise.

Coastal Areas Aided

This expansion is important to the coastal areas. Problems in other industry sectors have been somewhat eased. When difficulties arose in dried fish sales, many fishermen sold to filleting plants. Improved utilization has reduced operating costs, but these have been counterbalanced by higher prices for fish and increasing duties in the Common Market. The duty into France is 24% ad valorem, and into Western Germany and Benelux countries 16.2%.

Frionor's Annual Report

Frionor's last annual report showed major progress in selling more processed products--grill products, fish sticks and portions; these gained 34.5%. The regular fillet trade increased 26.4%. Sales of frozen fish in the round increased 23.2%.

The U.S. market has been the largest purchaser of Frionor products: about 38%.

Frionor noted good progress also in exports to EFTA countries and Australia, but exports to the Common Market declined somewhat due to recent tariff increases. Communist Bloc (COMECON) purchases, previously large buyers of Frionor products like saithe fillets, also declined. These sales have increased recently. (U.S. Embassy, Copenhagen, Aug. 13.)

* * *

VESSEL WILL FISH SALMON OFF GREENLAND

The Norwegian M/S 'Skrolsvik' recently headed for Greenland waters via Cape Farwell, Faeringehaven, and Disko Bay, where the gear will be tried out for salmon fishing. This is the first time in many years that a vessel from north Norway will participate in the salmon fishery off Greenland. About 25 Danish vessels fish in the area. Some from Møre, Norway, are expected to leave for Greenland waters.

600 Nets

Skrolsvik, manned by 10, is equipped with about 600 monofilament salmon nets; 500 of these will be used at first, the remainder held in reserve. The vessel will fish off West and East Greenland until November. Investment cost for gear, nets, floatage, drift material, and food is about US$36,700. (U.S. Embassy, Copenhagen, Aug. 11.)

* * *

REPLACES 120 SHRIMP PEELERS WITH TWO NEW MACHINES

Two Danish shrimp-peeling machines have been installed in Norway. If they meet expectations, they would operate 24 hours and peel 176 lbs. of raw shrimp an hour, or more than 4 metric tons a day. They would replace about 120 female shrimp peelers.

The two machines, including cost, transportation, installation, and additional equipment cost over US$70,000.

12 Machines Produced

A Danish engineer who installed them said his firm previously had manufactured 10 similar machines. Several were sent to Greenland; one to Alaska. With these machines, Norwegian shrimp production may soon equal Greenland's. The market for frozen shrimp is reported stable, and the demand increasing.

15 Vessels Supply Plants

The supply of raw material for Norway's industry has been much larger than industry was able to handle. Fifteen vessels now are delivering raw material to the peeling plants. Several of the vessels, however, had to ship their catches to other areas.

The new shrimp-peeling machines and 60 shrimp peelers are expected to handle more than 5 metric tons a day. (U.S. Embassy, Copenhagen, Aug. 4.)

USSR

ARTIFICIAL SATELLITES WILL AID FISHERY RESEARCH

Soviet scientists plan to use artificial earth satellites for fishery and oceanographic research. They believe satellites are necessary to exploit successfully resources in the seas far from shore and Continental Shelf. Some 156-187 million square miles will be surveyed.

At 10-15 day intervals, the satellites will map currents, temperature, chemical composition, and density of the waters. These data are essential for determining commercial concentrations of fish, other marine animals, and distribution by species.

Fishery Expansion Needed

There is a need for large-scale expansion of fisheries into the open oceans because stocks along coasts and on Continental Shelf fished by Soviets are approaching maximum sustainable yield. Global exploration for commercial concentrations of fish can be carried out only by satellites.

Plankton Surveys

The scientists also plan plankton surveys. They expect plankton to be used for human consumption in the future. Data on salinity, temperature, chemical composition, and density of ocean waters will be collected partly by satellites and partly by buoys that will transmit information to orbiting satellites.

Some studies of world's oceans already have been conducted by satellite "Soyuz-9". ('Izvestia,' July 1.)

* * *

TEST NEW TRAWLS, DEVELOP ACOUSTIC SYSTEM

The Kaliningrad fleet of Soviet Western Fisheries Administration is introducing aboard its 'Atlantik'-class factory stern trawlers a new, light weight bottom trawl with a vertical opening of 65.6 feet. This is 19.7 feet larger than opening of conventional trawls designed by Atlantic Fisheries Research Institute (ATLANTNIRO).

The new trawl makes it possible to increase vessel's towing speed to 6.6 knots and catches by 30%. The Far Eastern and Azov-Black Sea Fisheries Administrations will adopt the new trawl soon.

Test New Trawls

The Soviets also are testing in east-central Atlantic a large-mesh midwater trawl, and a wingless trawl with 20-inch mesh size. When tests are completed, the trawls will be introduced aboard Atlantik-class stern trawlers.

The lightweight bottom trawl with a large vertical opening is a modified conventional trawl. It is suitable only for very smooth bottom because a rough bottom would tear the light twine.

Large-Mesh Midwater Trawl

The large-mesh midwater trawl with very wide opening can be used for herring, mackerel, or alewives. The purpose of large-mesh netting at trawl mouth is to "corral" fish toward center and cod-end of trawl, where mesh size is reduced to normal 4.5-5 cm.

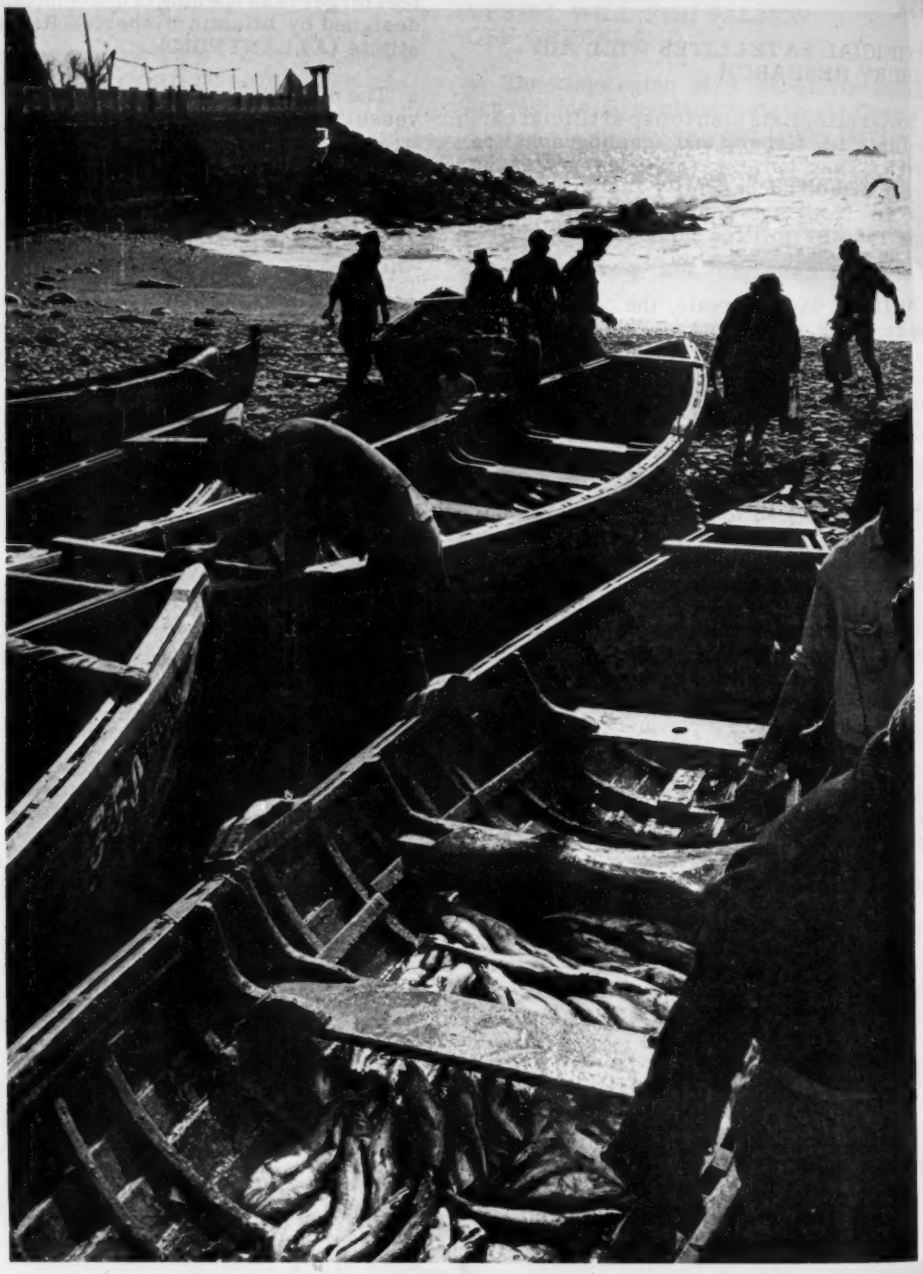
The Soviet mesh size is relatively "modest" compared to Canadians' midwater trawls with 42" meshes at trawl mouth tested in 1969.

If tests are successful, as Soviets claim, stern trawlers may be expected to use the new trawl to fish herring and mackerel.

New Underwater Acoustic System

The Sakhalin branch of the Soviet Science Academy has designed an underwater acoustic-electronic device ('Kalmar'), now in serial production. The device fits into a small buoy. It is intended to detect sounds made by marine mammals and warn against underwater earthquakes and tsunami waves.

The new device is not the echo-sounder 'Kalmar' used aboard Soviet vessels to locate fish schools.



CHILE: A small fishing port where fishermen sell catch directly to customers from open boats. (FAO: S. Larrain)

LATIN AMERICA

PERU

EPCHAP TAKES CONTROL

On July 1, Peru's EPCHAP assumed complete control of Peruvian fish meal and oil sale. EPCHAP is Empresa Publica para la Commercializacion de Harine y Aceite de Pescado. EPCHAP already had sold 30,000-40,000 tons of fish meal.

Although there are many unanswered questions about what payment fishmeal plants will receive, the operation is working and market conditions should hold up prices.

EPCHAP will receive 3% of gross value of meal it sells in payment for its marketing service. In 1969, this would have produced about C$6.6 million.

To Take Over Consorcio

To facilitate marketing, EPCHAP will take over control of the foreign and domestic installations and equipment of Consorcio Pesquero del Peru. The Consorcio has substantial cargo-discharging facilities in Stockton, California; Wilmington, North Carolina; and Europe. Previously, it has controlled 40% of Peru's fish-meal exports.

Because Consorcio has charged its members only 1.5% of gross value, movement is reported in industry to have government reduce 3% rate authorized for EPCHAP.

Closed Season For Anchovy

On July 1, the official newspaper, "El Peruano," announced a complete closed season, or "veda", for fishing anchovy (basis of fishmeal industry). It was to run from July 11 to August 31. The Government had imposed a partial veda on May 13. This allowed port of Ilo to continue operating; it also allowed fishmeal plants that had not caught 10,000 tons during regular season to catch 300,000 tons more.

This unusual "complete" closing may be response to fears that anchovy was overfished in 1969/70 season. The announced reason was to permit a joint Norwegian-Peruvian study of migratory habits of anchovy. This investigation will cost about $50,000 and involve marking 200,000 anchovy along coast during veda. Once fishing season opens, marked fish will be retrieved electronically at fishmeal plants. Presently little is known about anchovy's migratory habits. (U.S. Embassy, Lima, July 7.)

PANAMA

1969 SHRIMP CATCH
DROPPED BELOW 1968's

Panama's 1969 shrimp catch (preliminary information) was 12,230,892 lbs., down 969,460 lbs. from 1968. The 1969 figure does not include 231,714 lbs. of "Solencocera" variety.

Value of shrimp exported decreased from US$9.64 million in 1968 to slightly more than $9 million in 1969 (f.o.b. Balboa).

Catch of premium-grade whites remained close to levels of recent years. However, catch of pinks dropped to almost half of 1968 and to ten-year low.

Greater Production Sought

Industry and government are trying to develop more efficient use of marine resources. This may lead to greater shrimp production in the future.

Two developments are especially encouraging: 1) an experiment to forestall shrimping before shrimp reach maturity was conducted in March 1970; the results were promising.

The government, on recommendation of National Fishing Association, declared 1-month closed season on shrimping. Government studies concluded that industry was not getting maximum yield because shrimp, especially more valuable whites, were being caught before maturity. The experiment was considered very successful and probably will be repeated in 1971.

2) Industry experiments point to possibility of profitable shrimp fishing in waters not fished before. (U.S. Embassy, Panama, May 13.)

ASIA

JAPAN

TUNA CO-OP PLANS DIRECT SALES TO RETAILERS

In an effort to stabilize fish prices, the Federation of Japan Tuna Fisheries Cooperative Associations (NIKKATSUREN) plans to sell tuna directly to retailers. Fish wholesalers will be bypassed. Savings will be passed on to tuna producers and retailers by buying at high prices from producers and selling at low prices to retailers.

How It Would Work

The tuna purchased from vessel owners will be sold to retailers in round or dressed form. Since freshness cannot be determined until fish are thawed and cut open, NIKKATSUREN will assume the buyer's risk of getting round fish of substandard quality. In the beginning, retail outlets will be volume consumers--supermarkets, hotels, "sushi" (raw fish served with rice) restaurants, and wholesalers in outlying areas. A plan also under consideration would establish eventually cold-storages, distribution centers, and processing facilities in consumer areas.

Direct Sales Are Test

NIKKATSUREN's idea of direct sales will serve as a test case in reforming existing fish distribution system. Representatives of NIKKATSUREN and major supermarket chains have discussed the direct sales plan. Supermarket operators welcomed the idea as an improvement in customer service, although concerned about possible friction with established wholesalers and brokers.

NIKKATSUREN officials explained that they do not intend to ignore existing marketing structure. They hope venture will stimulate business. They stress the fact that direct sales would comprise only a fraction of fish trade's total volume, their objective conforms to Government's price stabilization policy.

The venture will be a 3-year experiment. During that period, NIKKATSUREN hopes to sell 7,430 metric tons of tuna worth US$6.89 million. ('Suisan Keizai Shimbun,' May 29.)

* * *

PLANS TUNA-REARING EXPERIMENT

Japan's Shizuoka Prefectural Fisheries Experimental Station plans a tuna-rearing experiment this year.

The first objective is to rear young bluefin taken in Suruga Bay's set-net fishery during May-Aug. each year to marketable size. This would increase their commercial value.

The ultimate aim is to rear the tuna to maturity and achieve spawning and fertilization under controlled conditions.

US$7,000 has been earmarked for the project, which includes building two octagonal floating pens for Uchiura Bay off Numazu City. Each side of the pen will be 16.4 feet long, the enclosure 30 feet deep. One-year-old bluefin trapped in the set nets will be transferred to the pens and reared until two years old. About 100 fish will be placed in each enclosure.

Bluefin Yearlings

Bluefin yearlings captured in the set nets measure 12-16 inches and weigh 0.7-1 pound. Two-year-olds reach 4-18 pounds. They would grow considerably if they could survive winter in Japan, where water temperatures drop to 12°C. (53.6°F.). This and feeding are the major problems in the experiment.

One Successful Experiment

The only successful Japanese bluefin rearing experiment so far was the one by Nagasaki Prefectural Fisheries Experiment Station. One tuna was kept alive for one month; the fish grew from 4 pounds to about 5.7 pounds. ('Suisan Keizai Shimbun,' Apr. 22, and Japanese press article from W.L. Klawe, IATTC.)

* * *

Apr. 1 and Mar. 31 Fiscal Year	Planned Sales		Estimated Average Monthly Sales	Estimated Average Price
	Quantity	Value		
	Metric Tons	US$1,000	Metric Tons	US$/Metric Ton
1970	1,286	1,072	160	833
1971	2,160	1,944	180	900
1972	3,984	3,873	332	972
	7,430	6,889		

JAPAN (Contd.):

INCREASE PRICE FOR EXPORT CANNED WHITE-MEAT TUNA

Effective May 12, the Tokyo Canned Tuna Sales Co. announced new prices for canned white-meat tuna packed in brine for export to U.S. In standard pack (48 7-oz. cans), new price reflects a US$0.55 increase, which brings U.S. destination price to around $17.70 a case.

Canned White Tuna in Brine Export Prices (Exwarehouse Shimizu)

Can & Case Size		Price per Case New Price US$	Old Price US$
Solid:	7-oz. 48's	13.22	12.67
	3½-oz. 48's	7.97	7.69
	13-oz. 24's	12.83	12.31
	66½-oz. 6's	15.28	14.64
	6.6-lb. 6's	26.39	25.28
Flake:	6½-oz. 48's	9.67	9.28
Chunk:	6.6-lb. 6's	23.58	22.56

Reason for Rise

Decision to raise price was based on: (1) lack of supply to meet vigorous demand by trading firms; (2) continued firm frozen tuna export market in U. S.; and (3) high albacore prices on domestic market.

Export prices for canned light meat tuna remain unchanged. ('Suisan Tsushin', May 11.)

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FROZEN-TUNA EXPORTS DROP DURING JAN.-JUNE 1970

During first-half 1970, Japanese frozen-tuna exports were 22,432 metric tons--about 10,500 tons, or 32%, below same period in 1969 and less than half 1968 period. Particularly notable is the sharp decline in exports of albacore, sold mostly to the U.S. ('Suisan Tsushin,' July 24.)

* * *

1969 LANDINGS WERE SLIGHTLY BELOW 1968's

In 1969, Japan's fishery landings totaled about 8.61 million metric tons (excluding whales), slightly below 1968 landings of 8.67 million tons. Decline was due largely to sharp reduction in squid and saury catches. ('Suisan Tsushin,' May 7.)

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NEW FIRM TO BUILD 1,100-GROSS-TON TUNA PURSE SEINER

On June 5, 1970, Overseas Purse Seine Fishing Co. was established with capital of US$194,000, invested jointly by 8 Japanese fishing firms. The new company plans to build a 1,100-gross-ton, 800-ton carrying capacity tuna purse seiner by Jan. or Feb. 1971 for use in eastern Pacific yellowfin tuna fishery.

Original plan was to have vessel built in U.S., but higher costs there ($2 million compared with about $1.6 million in Japan) changed plan. Total cost: about $1.8 million.

The company plans to hire a U.S. skipper. The seiner will have a brine-freezing unit (minimum temperature -18° C., or -0.4° F.), and 4 speedboats and one skiff to be purchased from U.S. for estimated $56,000. Deck gear will include power block costing about $83,000.

Plans For Seiner

The present plan is to send seiner in early 1971 to eastern Pacific yellowfin tuna regulatory area until season closes around April. Then vessel will operate 2-3 months outside area. If fishing is not good, it will go to Caribbean Sea and fish until mid-May. Then, across Atlantic to operate off west Africa. Operations may be extended to bluefin tuna fishery in Indian Ocean between Indonesia and Australia. Operational plan is for continuous fishing for 4 years without returning to Japan. Replacements (for 16-man crew) will be flown from Japan periodically.

Much Hope in New Industry

Industry hopes new company will modernize outmoded purse-seine fishery.

The Japanese Fisheries Agency intends to back the plan financially. It is considering a subsidy in fiscal 1971 for exploratory trips to develop new grounds. ('Suisan Tsushin,' June 8 & 9.)

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JAPAN (Contd.):

TUNA PURSE SEINER MODIFIED FOR EASTERN PACIFIC TRIP

The Japanese Kawajiri Gyogyo-owned purse seiner 'Hakuryu Maru No. 55' (499.5 gross tons) experienced failures in eastern Pacific yellowfin tuna fishery in 1969 and early 1970. It returned to Japan in late April for modifications.

Important Changes

Important changes included conversion to double deck, enlargement of fish holds, and improvement of engine system. Modifications were completed in mid-June.

The vessel is fishing off the Japanese islands until fall, when it will depart for eastern Pacific tuna fishery. ('Suisan Keizai Shimbun,' June 4.)

* * *

TUNA LONGLINERS FISH ATLANTIC IN RECORD NUMBERS

Around 250 tuna longliners were fishing in the Atlantic at the end of July, a record: 100 Taiwanese, over 70 South Korean, about 50 Japanese, and 10 each Cuban and Panamanian.

The Panamanian flag vessels are manned mostly by South Koreans, and practically all are under charter to a South Korean fishing company. (The use of foreign-registered vessels by Koreans is due to their country's law prohibiting import of vessels older than 7 years.)

Fleets May Increase

Tawian, and possibly Cuba and Panama, may add to its tuna fleet. Japan fears increased Atlantic tuna fishing effort may lead to Atlantic Tuna Commission's questioning of longline-fishing intensity. In the past, the Japanese had close to 180 longliners in the Atlantic during peak periods. They believe tuna fishing most stable when this fleet numbered about 100-120 vessels. ('Suisan Tsushin,' July 30.)

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LARGE STERN TRAWLER WILL BE BUILT

A 5,300-gross-ton stern trawler, largest of its kind in Japan, will be built by Usuki Shipyard for Hoko Suisan Fishing Co. Construction is to start Dec. 1970 and be completed by Oct. 1971.

Outstanding Features

Outstanding features will be a "surimi" (minced fish meat) producing plant and plants to reduce fish into meal and solubles. The vessel will join Hoko Suisan's 4,252-ton trawler 'Katata Maru' in the North Pacific. ('Suisan Keizai Shimbun,' July 13.)

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TWO TRAWLERS SENT TO NORTHWEST ATLANTIC

On April 11, 1970, the Japanese Fisheries Agency licensed two stern trawlers for the northwestern Atlantic north of 45° N. lat. on a 6-month experimental basis. The vessels, owned by Nihon Suisan, are: 'Tokachi Maru' (2,501 gross tons) and 'Zao Maru' (2,530 gross tons).

In 1971, the firm plans to send to northwest Atlantic a 4,000-ton-class stern trawler costing over US$4 million.

In the past, several major Japanese fishery firms have explored in that area for alternate resources for their trawlers operating off west Africa.

Membership In ICNAF Sought

The Fisheries Agency is seeking Diet (parliament) approval of Japan's membership in International Commission for the Northwest Atlantic Fisheries (ICNAF). If admission is gained, Japanese trawlers will be allowed to extend operations beyond present northern boundary established by the Agency. ('Shin Suisan Shimbun,' May 11.)

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JAPAN (Contd.):

LICENSES 33 VESSELS FOR EASTERN PACIFIC SAURY FISHING

The Japanese Fisheries Agency decided to license 33 saury vessels this year to fish in the North Pacific east of 165° E. longitude. The 33 do not include the 2 vessels licensed in early 1970 for exploratory saury fishing in the eastern Pacific. The 2 vessels received a 75-million-yen (US$208,000) Government subsidy.

Applications Limited

By mid-July, owners filed applications for 44 vessels. To limit number to 33, June 20 was set as cutoff application date. Decision was based on fear that unrestricted fishing off North America would create international problems and might irritate U.S. fishermen. The Agency action showed the government was controlling saury operations. (In 1969, 7 Japanese vessels fished saury in eastern Pacific.) Most of the vessels vary from 291 to 549 gross tons. Included is a 1,167-ton mothership (with three 96-ton vessels) and one 690-ton mothership (with 296-ton vessels).

2 Fishing E. Pacific

In mid-July, 2 of the 33 vessels licensed were fishing in eastern Pacific. The 535-ton 'Tone Maru' was off San Francisco, exploring northward toward Seattle. It was landing about 1 ton of saury a day. Size of fish was small and schools sparse. This indicated best fishing season in that region may be from around late-Aug. to Oct.

Subsidized Saury Explorations

The 2 trawlers exploring for saury in North Pacific on Government-subsidized cruise are 'Akebono Maru No. 15' (499 gross tons) and 'Habomai Maru No. 21' (299 gross tons). These were fishing in central Pacific between 160° E. and 170° E. longitudes. Fishing was not good; catches average 2 to 4 tons per vessel a day. The 2 vessels were scheduled to return to Japan in September. They will depart then for west coast of North America (Pacific Northwest). ('Suisan Tsushin,' July 15 & 22.)

* * *

JAPANESE & MAURITIANS SIGN TUNA-FISHING AGREEMENT

A new tuna fishing/cannery agreement was signed July 15 by Japanese and Mauritian interests. The invested capital for new firm, Mauritius Tuna Fish and Canning Enterprises, Ltd. is about US$800,000; each side has half the shares.

Job Possibilities

It is hoped that up to 1,200 Mauritians will get jobs: some on new vessel to be purchased, others in cannery and tin-producing plants to begin operation early in 1971, and others in cold-storage plant under consideration.

After the signing ceremonies, Mauritius Minister of Commerce Guy Marchand, sensitive to local unemployment, emphasized these employment possibilities at a press conference. (U.S. Emb., Port Louis, July 18.)

* * *

JAPAN & S. KOREA WILL DISCUSS CONTINENTAL SHELF BOUNDARY

Japanese and S. Korean firms plan to exploit oil and natural gas resources on Continental Shelf in Sanin coastal area, Korean Straits, and East China Sea. The plans are incentive for negotiations to establish a boundary on Continental Shelf between the two countries.

Korean "Sea-Bed Mineral Resources Development Law," Jan. 1970, set up 7 mining areas on Shelf; 3 of these overlapped areas Japanese seek to exploit.

Talks in Fall

Both Korea and Japan are expected to "suspend" claimed rights over Shelf until agreement is reached. Talks are to begin in September or October. ('Asahi,' July 9.)

Neither country is party to Convention on the Continental Shelf. It provides that, in absence of other agreement, Continental Shelf boundary between two member countries is median line.

NORTH VIETNAM

FISHERIES MINISTER SEEKS POLISH AID

During a visit to Poland, the North Vietnamese Minister of Fisheries, Nguyen Trong Tinh, was interviewed by a Gdansk newspaper, 'Glos Wybrzeza'. Tinh said:

". . .Fish is the second staple after rice for the North Vietnamese. It is thus not surprising that the Government attaches so much importance to the increase in fishery catches--the second bread of Vietnam.

"At the time of France's colonial rule over Vietnam there existed only private fishing. Influential shipowners, representing French capital, exploited fishermen. The situation changed after we gained independence. Private fishing enterprises ceased to exist. Cooperatives were set up run by the fishermen themselves."

Fishing During War

How do they fish during war?

"Our fishermen sailed on the Bay of Tonkin at night. Units which did not manage to come back before daybreak fought against the enemy. Fishing units barely equipped with arms shot down 32 aircraft."

Development Plans

"Fishing is administered by the Central Office of Fisheries Administration, established in 1960. State and cooperative enterprises are subordinate to it. The Office's task is to work out plans for the development of fishing and supervise it.

"The plans envisage the development of the three basic sectors of fishing: breeding (fish culture), catching, and processing. Availing ourselves of the assistance of the socialist countries, especially Poland, we want to develop gradually all kinds of fishing, from boat fishing in the Bay of Tonkin to trawler fishing in the South China Sea.

"The abundance of fish in the Bay of Tonkin makes it possible to intensify fishing by introducing gradually limited mechanization. This applies to processing as well. At present the processing industry produces sauces and fried fish. The long-term plan envisages the setting up of 2 new central enterprises and 8 provincial ones. In this way a large state fishing enterprise will be situated in every seashore province.

"At present North Vietnam has about 8,000 various kinds of vessels catching about 500,000 metric tons of fish. Among them are the traditional junks but we have more and more motorboats. The enterprise in Haiphong has two refrigerating (freezer) trawlers and well-organized preserving (canning) and fish meal plants, constructed with the assistance of Soviet specialists.

"The Bay of Tonkin, abounding in fish (there are more than 900 species), guarantees. . .the possibility of a rapid development of fishing."

"Minister Tinh's current visit to Poland is also to serve this goal," the newspaper said.

TAIWAN

TUNA FISHERY GROUP FORMED

On June 16, the Taiwan Regional Tuna Exporters Association was formally established to represent tuna producers and exporters. It will help to obtain government loans and provide guarantees. Presently, its activities are limited to advisory services.

60 Members So Far

Only 60 of Taiwan's 352 companies in tuna fisheries and exports have joined. Eventually, all companies in the tuna industry are expected to participate. ('Katsuomaguro Tsushin,' June 26.)

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☆U. S. GOVERNMENT PRINTING OFFICE : 1970 435-334/

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Massachusetts State Fishery Biologist checks mixed catch aboard BCF's 'Albatross IV'.

(R. K. Brigham)